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THE

TROPICAL AGRICULTURIST:

A

PRACTICAL TREATISE

ON

THE CULTIVATION AND MANAGEMENT

OF

VARIOUS PRODUCTIONS

SUITED TO TROPICAL CLIMATES.

By GEORGE RICHARDSON PORTER,

AUTHOR OF "THE NATURE AND PROPERTIES OF THE SUGAR CANE," ETC. ETC.

"It is both the duty and interest of every Owner and Cultivator of the Soil to study the best means of rendering that soil subservient to his own and the general wants of the community; and he who introduces, beneficially, a new and useful *Seed*, *Plant*, or *Shrub* into his district, is a blessing and an honour to his country."

SIR J. SINCLAIR.

LONDON:

SMITH, ELDER AND CO., 65, CORNHILL.

1833.

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INTRODUCTION.

THE wonderful fecundity of Nature, when excited by the influence of a tropical sun, has enabled the cultivators of our intertropical colonies to draw from the soil an uninterrupted succession of harvests of the same description, and has caused their attention to be diverted from various other branches of agriculture to which those colonies are equally well adapted.

So long as the continually growing demand in Europe for one favoured article of production could be met only from its extended cultivation in our older-settled sugar colonies, the planters had no sufficient motive for directing their attention to other objects of production. Now, however, that the peaceful arts have been permitted to take root in other but equally prolific settlements, and that the sugar of those countries is allowed to meet that of our West India islands in every market of Europe, it becomes a question of importance whether means cannot be devised for diminishing our growth of

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sugar so as again to bring the supply within the real and effective demand, and thus enable the grower to obtain a fair return for his capital, without at the same time submitting to sacrifices of any other description.

This object will probably be found neither unattainable nor difficult of accomplishment; and it is one principal aim of the following pages to describe how means, which are abundantly supplied by the hand of nature, can be best improved and rendered most available to this desirable end.

If in every country it were possible to produce with equal advantage every substance necessary or desirable for the sustenance and convenience of its inhabitants, commerce, which does so much for the spread of civilization, would be without one of its main incentives. But for the desire of obtaining the sugar, spices, and drugs of India, the condition and capabilities of the people inhabiting that interesting country might have continued still unknown to Europeans; and it is to the taste acquired for the leaves of an aromatic herb, that we principally owe what little information has been obtained concerning that singular people the Chinese. This incitement to commercial enterprize it is, that has led to the settlement of colonies in climates differing from that of the parent state, which thus obtains the double advantage of obtaining from its own children articles which add to the

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sum of its convenience, and of setting in motion its own domestic industry to provide acceptable returns for those articles.

Of all the vegetable productions capable of being propagated within the tropics, a very large proportion are objects of desire in Europe. As regards many of these productions, there can be no doubt that if by the employment of additional capital, or the introduction of better systems of management, they could be furnished at a cheaper cost than at present, their use would be proportionally increased in the parent state, to the manifest advantage of colonial cultivators.

It is seldom that any good reason can be of fered why land in any country should be exclu sively devoted to the raising of one particular description of produce. A long experience has shown that the contrary practice is beneficial in the temperate regions of Europe; and although by reason of the greater energy of vegetation within the tropics, the system of rotations, so indispensable with us, may there to a certain extent be disregarded, this offers no argument against the adoption of that system, since by its means a still greater power of production may be called into action.

The English farmer who, following in other respects the ordinary rules of tillage, should devote his acres to the production of only one description of

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produce, would soon exhaust his land to such a degree, that the diminished harvest would be inadequate to replace the cost of production. If, with the hope of counteracting this law of deterioration, he were to employ an increased amount of capital in manuring the soil, a similar result would even then be experienced, since the expense would be found out of all proportion greater than the returns. Let us suppose, however, that by a concurrence of circumstances, such an inducement should be offered in the price of one particular species of grain — wheat for instance — that for a series of years would warrant the application of means for its constant production, but that at length this state of things should be changed;—that wheat, the produce of other lands were then brought into the same market with his own, or that the demand for that particular grain should be lessened, the price, as a natural consequence, falling until the excessive cost of its production was no longer returned to the farmer; —what course would he then necessarily adopt? Would he persist in the expensive and forced cultivation of that for which an adequate demand no longer existed? Would he not rather betake him to some less costly tillage, and seeking to acquire the best means of producing other articles for which a market was still open to him, endeavour to guard as much as possible against those accidents and changes to which all human pursuits are in some degree exposed?

In the attempt made in this volume to supply in-

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formation, that may guide the colonial agriculturist in a similar conjuncture, it is not intended to bring forward systems for adoption which have not experience for their recommendation, but rather to present in one view, the practices successfully pursued in various countries, where the culture of each particular object is supposed to be best understood. In cases, where any variance from these practices is suggested, it is done with the view of rendering them more applicable to different localities; while in every case the reasons upon which such suggestions are grounded, are so stated as to enable the reader to form his own opinion with regard to their propriety.

Some of the more important articles of commerce noticed in these pages are already, and, indeed, from their earliest settlement, have always been cultivated in the greater number of English colonies within the tropics. One of them — coffee — is still an object of great interest in many of those colonies; but as regards other productions, most of them are nearly unknown to the cultivators, while others have, from a variety of causes, ceased to offer their former interest to the planter. It would be fruitless to detain the reader by inquiring into the origin and operation of those causes. Some of them are, doubtless, of a temporary character, while in many cases it may be, that want of success has been partly occasioned by the pursuit of faulty processes, which have not hitherto been amended, because a more promising object of pursuit has engrossed the attention.

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The altered state of circumstances affecting colonial property now calls, however, for the adoption of a different course, and it is hoped that the endeavour here made to give a more favourable direction to efforts, which of late years have issued in little else than disappointment, will not be without benefit to a much respected and numerous class of our fellow-subjects.

London, February 1833.

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LIST OF ENGRAVINGS.

Blossom, Pod, and Ripe Cotton		Frontispiece.
Cotton	*Gossypium Herbaceum*	Page 3
Cotton Tree	*Gossypium Arboreum*	50
Coffee Tree	*Coffea Arabica*	57
Cacao Tree	*Theobroma Cacao*	92
Cacao Fruit		95
Vanilla	*Vanilla Aromatica*	111
Tea	*Thea Viridis*	126
Tobacco	*Nicotiana Tabacum*	149
Rice	*Oriza Sativa*	171
Maize or Indian Corn	*Zea Mais*	198
Great Indian Millet	*Holcus Sorghum*	213
Common Millet	*Panicum Miliaceum*	217
Palm Sago	*Sagus Farinifera*	225
Cassava	*Jatropha Manihot*	233
Arrow Root	*Maranta Arundinacea*	239
Coco-Nut Palms	*Cocos Nucifera*	247
Cinnamon Tree	*Cinnamomum Verum*	277
Clove Tree	*Caryophyllata*	289
Nutmeg	*Myristica Moschata*	299
Pepper	*Piper Nigrum*	308
Ginger	*Amomum Zingiber*	319
Pimento	*Myrtus Pimento*	324
Cardamom	*Elettaria Cardamomum*	330

Digitized by Google

		Page
Indigo	*Indigofera Tinctoria*	338
Poppies, from which Opium is produced		372
Senna	*Cassia Senna*	379
Cajuputi	*Melaleuca Cajuputi*	382
Camphor Tree	*Dryobalanops Camphoræ*	386
———	*Laurus Camphora*	391
Rhubarb	*Rheum Palmatum*	398
Socotrine Aloes	*Aloe Socotrina*	404
Castor-Oil Plant	*Ricinus Communis*	412
Star-Aniseed	*Illicium*	418

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THE

TROPICAL AGRICULTURIST.

COTTON.

Gossypium—a genus of the *Polyandria* order, belonging to the *Monodelphia* class of plants, and ranking in the natural method under the order of *Columnifera*.

THE cultivation of cotton has been carried on from time immemorial on the continent of India, and in many of the islands in the Indian ocean, where at a very remote period, a degree of proficiency was attained in the arts of spinning and weaving its woolly fibres, to which with all our mechanical aids we have never fully arrived in Europe.

This production is likewise indigenous to Africa. From the earliest records, we know that its cultivation was prosecuted in Egypt, and there, as well as in Morocco, on the coasts of Barbary, at Sierra Leone, and on various parts of the Western coast, cotton is at the present day produced in great abundance. Large supplies of the wool, as well as of goods manufactured with this substance, form part also of the caravan trade from the interior of Africa.

We know also that when the Spaniards first accomplished the conquest of Mexico they found the cotton plant in that country, and its produce in extensive use among its inhabitants. Its cultivation would naturally follow at a very early period in the various settlements made by Europeans in the tropical islands of America.

The instances are not many in which equally important

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gifts have been found so widely diffused by the hand of Nature. The extension of its cultivation to other countries, and particularly throughout the south-western parts of Europe is principally owing to the Arabs, who in their various incursions carried with them this important plant, and who thus, adding by its means to the present and future comforts of those whom they came to subjugate, made some amends for evils which their swords inflicted.

The use of cotton is not confined, however, to the countries of its production; in fact there is no substance drawn from the vegetable kingdom, the adaptation of which to manufacturing purposes is equally extended, so that at the present day, a large proportion of the clothing of the human race almost throughout the habitable globe is formed of the filaments of the cotton plant. This is especially the case in warm climates, where fabrics which are at once light and absorbent—both which qualities are eminently possessed by cotton—are admirably suited for clothing purposes. It would occupy much space to describe, or even to name all the various articles of convenience and of beauty now made with this substance, or towards the composition of which it is made to contribute. The very limited number of pages that can be allotted to the subject in this volume, will be otherwise fully taken up with notices of the varieties of the plant, their several relative advantages, and the particular modes of culture pursued in the different countries where it is raised.

Botanists describe several species of the cotton plant. Willdenow has enumerated ten, drawing their characteristic distinctions principally from the forms of their leaves and the size of the trees; they may be distinguished as follows:

1. *Gossypium herbaceum*—Grows to the height of eighteen or twenty-four inches. Its stem is ligneous, cylindrical, reddish below, downy in the upper part, and furnished with short branches. The leaves are five-lobed, short, broad, roundish, and terminating in a point, growing upon hairy petioles or footstalks two or three inches long. The peduncles, or stalks that support the fructification,

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GOSSYPIUM HERBACEUM.

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spring from the axilla of the upper leaves, and each bears a yellow flower like to that of a mallow. This flower has three large, short, and deeply serrated leaves belonging to its calyx. This species of cotton was derived from Syria and India, was afterwards cultivated in Malta and Sicily, and at a later period has been introduced into North America.

2. *Gossypium Indicum.*—A shrub which will attain the height of ten or twelve feet, and whose stem will live for several years. The branches are downy. The leaves are of a medium size, or rather small, especially the upper ones. They have mostly three lobes, which are oval and pointed; their petioles are downy. The flowers are large, on short peduncles, the three leaves of their outer calyx are sometimes plain and sometimes serrated. The petals are yellow with a purple spot at their base. The capsules are oval and conical, and open by three or four valves, The seeds are roundish, and the cotton by which they are enveloped adheres very strongly to them. This species, as its name denotes, is indigenous to India.

3. *Gossypium Micranthum*—Grows on a reddish stalk, to the height of eighteen inches; the leaves are divided into five obtuse, almost rounded, lobes. The stem, petioles, and peduncles, are all thickly set with blackish points. The corolla is yellow, the petals are oval, pointed, and rather downy on the outside. Persia is the native country of this kind.

4. *Gossypium Arboreum.*—This species is easily distinguished from others. The five lobes of its leaves are long, lanceolate, and digitated; its flowers are of a brownish red. The tree attains the height of from ten to fifteen feet; the branches are smooth, except at their extremities, where they are furnished with very short hairs. The peduncles are short and bear largish flowers of a red colour, somewhat like a lily, pretty, but without smell. The capsules are oval and pointed, and open in three or four compartments, each containing three or four seeds

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enveloped by white cotton, which is abundant and of good quality. This kind is found in Egypt, Arabia, and the islands of the Indian ocean.

5. *Gossypium Vitifolium* — Is readily known by its leaves, which are large, palmated, deeply divided into five oval lanceolate lobes very pointed, smooth above and rather downy underneath. The branches and petioles are very smooth. This species bears large yellow flowers, spotted internally with purple at the base. It is met with in the isle of France, in Celebes, and in various parts of South America.
6. *Gossypium hirsutum.*—This species has its leaves divided into five lobes which are pointed, and the middle one of which is larger than the others. It produces cotton which is white, silky, and much esteemed, and grows in the hottest parts of America.
7. *Gossypium religiosum.*—The leaves of this are much less divided than those of the *g. vitifolium*, and they are not palmated. This shrub grows to the height of three or four feet; its branches and petioles are downy. The leaves are green and shining; the flowers are large and commonly of a sulphur yellow with a rosy or purplish tint near their border: occasionally they are seen entirely white. The pods, which are short and pointed, have an oval form, and the cotton they contain is very fine and white, but adheres most tenaciously to the seeds, for which reason it has never been much cultivated. It is said to have come from the Cape of Good Hope, but this point is not sufficiently established.
8. *Gossypium latifolium*—Grows to the height of more than four feet, has a ligneous stalk, its branches and petioles are covered with black tuberculous points. The leaves are large, broad, shining, and of rather a dark green colour; the lower ones are oval, pointed, aud entire; the others are deeply divided into three pointed lobes. In other respects it much resembles the *g. vitifolium*, of which it has been thought to be a variety. It is met with in the West India islands.

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9. *Gossypium Barbadense*—Grows naturally in the island of Barbados, whence it derives its name; yet it is but little known among cultivators. Its leaves are divided into three lobes which are pointed.
10. *Gossypium Peruvianum*—Likewise derives its name from the country where it was first observed. It grows to the height of three feet with a straight smooth stem which is of a green or ashy colour. The leaves are large, heart-shaped, and covered with a very fine down.

Cultivators have spoken of a more considerable number of species, but there is reason to believe that many of these are only varieties which have been induced in the course of ages by diversities of climate and soil, or by the various modes of culture to which the plant has been subjected. Cotton plants, in fact, appear more subject than the generality of vegetable productions to run into varieties, so that it is not by any means uncommon to observe in different branches of even the same plant, leaves of two or three dissimilar conformations. Where so much uncertainty exists, there is room for endless controversy, which it is evident cannot lead to any practical result, since, with the knowledge at present possessed, no classification could possibly be made that the observant cultivator would not find disturbed in the course of his experience. So true is this, that Dr. Rohr, a Danish gentleman, who resided during a great number of years in the island of St. Croix, where he bestowed the greatest attention upon the cultivation of his cotton plantation, and to whom the world is indebted for a clever treatise on the subject, found himself all unable when classing his plants, to depend upon the usual characteristics drawn from the organs of vegetation and fructification generally, and was obliged to seek in the forms and modifications of the seeds alone for the true distinctive characters of the species. It is objected to the system thus proposed and formed for himself by Dr. Rohr, that from the manner of his description it can be rendered of but little practical utility to other cultivators.

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As a point of natural history, the correct classification of all the different species of cotton plants is well deserving of attention on the part of botanists, who have performed like services with regard to various other plants certainly not entitled to obtain any preference over cotton, if considered with reference to their relative importance in domestic economy, or to the interest they possess for the merchant and manufacturer. Such a task is, however, foreign from the purpose of this work, wherein some descriptions of the more general characteristics of the varieties most esteemed and cultivated in different places, will prove of greater practical utility to the planter, than the most scientific botanical disquisition.

The cotton plant succeeds better in light and sandy soils, than in such as are heavy and clayey;—in those which are only moderately moist, than in such as are either arid or greatly impregnated with humidity. Its roots do not require any great depth of vegetable mould, but they put forth a great number of slender and delicate fibres, whence it is requisite for the soil to be light and well broken by tillage. It is however necessary, that the principal tap-root should be able to penetrate to a certain depth. Should the growth of this root be stopped near to the surface by a bed of rock, or by very tenacious earth, it would expend its vigour in putting forth lateral fibres; the plant would not have a proper hold of the soil, neither would it be equally hardy, nor would its produce be abundant. If the soil be too rich, the shrub will push forth vigorously and produce a great quantity of flowers, but these will soon fall, and the hopes of the planter will be disappointed. The same misfortune occurs when the ground is surcharged with moisture, besides which, the seeds first, and at a later stage the roots, are liable to rot in the ground, so that in one case the plant never appears, and in the other it quickly perishes. A variety of cotton is indeed cultivated with success in places where the soil is naturally very moist, as in Guiana; but there the evil is remedied by the adoption of an efficient system of drainage.

If the soil is sterile and too dry, and these defects are not corrected by means of manure and artificial watering periodi-

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cally performed, the plant will scarcely develope itself; it will languish, giving little if any produce, and inadequately returning the expense of cultivation.

Volcanic deposits are found to be, without any comparison, the most favourable of all soils for the vegetation and production of cotton. Fine sand, the particles of which are held together by a small portion of clay or calcareous earth, is scarcely less desirable, and particularly if mixed with a certain quantum of decomposed vegetable matter. The plant in these cases, although its growth is not luxuriant, will furnish an abundance of cotton of excellent quality, and what is of great importance, it arrives sooner than usual at maturity.

Cotton may be cultivated on soils of such very moderate fertility, that it would often be difficult to procure from them any other kind of harvest.

If the land destined for a cotton plantation is moist to excess, or if the rain is likely to lodge and be detained within a small distance from the surface, it will be indispensably necessary to prepare for the reception of the seed by forming trenches through which the water can be drained away. If, on the other hand, the soil should be too dry, channels less deeply cut must be provided in order to receive and retain for awhile any partial showers that may fall, and these channels may be made equally to serve the purpose of drains when the seasons prove excessively rainy.

Ground which has remained long under fallow, and which for want of being disturbed is overstocked with weeds, must in order to prepare it for sowing, be thoroughly worked, so that the roots of the weeds may be completely destroyed, and the ground itself well pulverized. In all cases where its application is practicable, the plough should be used for this purpose, both on account of its diminishing the toil of the labourers, and because the land by its means is equably and thoroughly disturbed, and at a less expence than by hand labour. The ploughings to be effectual must be not less than twelve or even fifteen inches deep, so that the tap-root may easily penetrate to the requisite depth. Lands should be ploughed three times,

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leaving a considerable interval of time between each of the ploughings: the last of these should immediately precede the sowing of the seed. If the land is already well pulverized and free from weeds, two ploughings may suffice; but in the contrary case, it may be necessary to extend the process even beyond the third ploughing. A harrow or roller should be used after every turning up of the soil, in order to break the clods, and to bring the land into a state of more minute division.

There is less need of manuring land for the reception of cotton seed, than for the production of most other objects of cultivation. It must not be thought, however, that cotton planters can always and altogether dispense with the employment of manure. There are very few lands qualified by nature for yielding harvest after harvest, without having their productive powers renewed and quickened by the application of some compost. Such soils, if they could be found, would be ill adapted to the production of cotton; a certain degree of fertility is, however, indispensable, and although the light, sandy soils most frequently chosen for cotton plantations, are the best qualified for the purpose, they yet in a short time become exhausted, and if unaided will be converted into sterile wastes.

The choice of manures best fitted for restoring the exhausted powers of the land, should be made to depend upon its original properties. A want of knowledge and consideration upon this point, has often led to wasteful expenditure and serious disappointment. A cold clay requires to be treated differently from a light siliceous soil; and low swampy ground, the fertility of which has been impaired, must necessarily require a course the opposite to that which would be proper where the land is dry. To produce all the good effects attainable in this respect, the chemical composition of the soil should be examined, its deficiences aided, and its evil qualities corrected, by means which science has suggested and experience sanctioned. Where a deficiency of vegetable matter is perceptible, there manure must be effectual to supply it; where noxious principles exist, these should be corrected through the application of bodies, whereby what is hurtful will be decomposed.

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Iron, the most useful of all the metals with which man is acquainted, is also the most widely diffused, and, but for the aid of chemical knowledge, might prove almost as detrimental in some cases as it is serviceable in others. How many soils, are, in their natural state, rendered unproductive by the presence of some of the salts of iron, and which being decomposed by the application of alkaline earths—such as lime—their fertile powers are brought into action. Lime, chalk, sea-shells, and sand, are all useful in remedying defects where the soil is heavy or swampy; where it is worn by previous culture, animal or vegetable manures are requisite, but these should never be used in combination with alkaline substances, which would render the fertilizing matter of manure insoluble and inert, and consequently prevent its absorption during their growth by the plants which it is designed to nourish. It would be impossible, in any satisfactory manner, to describe the proper treatment of soils within the limited space that can be afforded in this volume. On this subject, the reader will do well to consult the masterly lectures delivered by Sir Humphrey Davy, before the Board of Agriculture, and afterwards published by him under the title of "Elements of Agricultural Chemistry." In the sixth, seventh, and eighth of these lectures, the whole subject is fully treated.

The choice of seed is a thing of the first consequence to a cotton planter, and too much carefulness can hardly be shewn in this particular. If purchased in the ordinary course of traffic, it will not be possible to guard against obtaining a mixture of seed of different species, which indeed may happen even when no fraud is intended. The generality of cotton planters in our colonies, shut their eyes to the importance of this principal means for securing the best return for their outlay and labour; and it is too common to observe a great number of varieties of the plant growing together in the same field. The produce obtainable from these varies extremely, so that some trees will yield little more than an ounce of clean picked cotton annually, while other kinds will furnish ten or twelve ounces, the quality of which will, at the same time, be superior to that of the smaller bearers. Another disadvantage attends this mixture

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of varieties, arising from the difference observable in the times of maturing their fruit, so that the labour of the plantation is materially and unnecessarily increased by prolonging the time of gathering.

The cultivation of cotton, which was carried on to a considerable extent in former years in our West India colonies, has of late been almost entirely abandoned there, because the prices of this article in the markets of Europe have fallen so low as to be no longer remunerative, and plantations, which once maintained their proprietors in affluence, would not, if similarly managed, now repay the current expences of their cultivation. How are we to account for this reduction in prices? Not certainly from any falling-off in the demand, which is so far from being diminished, that from year to year it has been advancing after a steady and important rate of progression. Nor yet can this fall in the money value of cotton be ascribed to the discovery of any new source of supply from countries, where its cultivation is conducted at a diminished cost, since the principal importations are obtained from a country — the southern parts of the United States of America — where, although land is cheap, daily labour is uniformly dear, and the climate is assuredly not more favourable than is that of the West Indies to the perfection of the plant. The high prices of former times occasioned a great degree of carelessness on the part of planters, who for that reason were not in a situation to meet the depression of prices, occasioned by the increasing supplies raised in the United States. But to what cause are we to attribute this constant augmentation of growth in that country in the face of a reduction in prices, which has driven the West Indian cultivator from the market, unless it be to a greater degree of productiveness in the varieties cultivated, joined probably to greater agricultural knowledge? If there be any foundation for this opinion, the same course is obviously and equally open to the planters in our own western colonies, several of which are known to be admirably fitted by nature for this branch of husbandry.

It is allowed to be a difficult task, and one which has rarely been attended with success, to attempt the re-establishment

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in any country, of pursuits that have once been laid aside as unprofitable; but in the present state of the West India colonies, the necessity for some effort of this nature seems to be urgent; and it is hoped that the circumstance here pointed out, may shew, at least the possibility of attaining to better success than formerly, provided careful and judicious modes of cultivation be adopted.

That little understood, but generally acknowledged law of nature, whereby plants which are produced and reproduced from a succession of seeds sown upon the same spot, are seen to degenerate, makes it disadvantageous for the planter to depend wholly upon his own resources for his supply of seed. Were it otherwise, his course would be materially simplified; and by a careful selection from the produce of his own fields, any cultivator might, in the course of a few seasons, possess a succession of none but the most profitable description of plants. At first it may be the better course to encounter this chance of degeneration, rather than be exposed to the almost certainty of the seeds being mixed. The former evil may be mitigated by exchanging, as far as practicable, the seeds of different fields on the plantation, and it is presumed, that after a few years, the advantages seen to attend a careful selection of varieties, would convince other proprietors of the necessity for adopting the same course, and it would then no longer be difficult to establish a regular exchange of seeds, upon which every dependance could be placed.

The seeds of plants which yield the best description of cotton, are not always equally good. Some will be immature, while others may be too much burnt by the sun. Perhaps the best test of their vegetative quality is furnished by their specific gravity; and if the practice which is common amongst farmers in this country, were adopted, of throwing the seeds into water, and rejecting all which do not sink, a more uniformly good result might be obtained. The heaviest seed, the covering of which is hardest and least yielding to pressure, is the best. It is usual to employ always that which is of the growth of the preceding year, under the impression, that if older, its power of germination is lessened. It is difficult,

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however, to imagine that their vitality is so easily impaired; and indeed M. Lasteyrie acquaints us, that seed which he obtained from Spain succeeded perfectly well, although it was not sown until the end of three years. It will in general be easy to procure seed of the preceding season, and, except as matter of experiment, it may therefore be the safest plan to use only such.

Some persons are accustomed to soak their seed in water for twelve hours or longer, just before it is sown, with the view of hastening its germination; this course is more generally pursued when the season is drier than usual. It may be suggested as probably an improvement upon this plan, to soak the seed in train oil, since the process has been found an excellent preservative, in some other cases, against the ravages of insects, and these, it will be seen, are a frequent cause of injury to the cotton planter.

The method of sowing most commonly pursued in the West Indies with land which has not yet been cleared, is to fell and set fire to the trees, and dig holes for sowing the seeds. These holes are placed in straight lines, and disposed in a quincunx form. They should be from fifteen to eighteen inches deep, and about a foot wide. The principal root very speedily shoots downward to the depth of twelve inches or more, and it is of importance to the vigour of the plant, that no obstacle should oppose itself to this growth. This rule may be somewhat modified according to the nature of the soil, and as regards the present practice, it is made to bend very much to suit the ideas of individual planters. The best shape for these holes is that of a square, as wide at the bottom as at the top, otherwise the roots of all the seeds which in the first instance are deposited, will shoot in the loosened earth, and if this is contracted towards the bottom, the roots will become so interlaced, that it will be difficult, if not impossible, in withdrawing the superfluous shoots, as afterwards explained, to avoid injuring those which are to remain. When these have been dug, and before the seed is sown, they must be filled again lightly to the level of the soil. If raised higher than this, the heavy rains which fall within the tropics, might carry

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away the earth together with the seed; and if, on the contrary, this were sown much lower than the level, the rain would lodge in the holes and rot the seed.

It is impossible to prescribe the exact distance to be preserved in every case, between cotton plants, since this must be modified to suit the habits of different varieties, and according to circumstances of climate and soil. In level and fertile districts, it has been usual to leave larger intervals than in poor and mountainous situations, a course, apparently of very doubtful policy. It would be an easy experiment for any cultivator to sow a few trees of different varieties, at unequal distances in separate parts of the plantation, by which means he might ascertain not only which variety is best suited to the soil, but also what intervals it would be most advantageous to leave between the plants, both questions of considerable importance. As respects the first, Mr. Rohr has given us a sufficient proof of this importance, by stating that the seeds of a particular description of cotton, which had been grown upon his plantation, and had yielded no more than one ounce and a quarter of cotton per plant, produced abundantly when planted by one of his neighbours in a soil no wise superior to that whence the seeds were taken.

The exact spots at which the holes must be dug, are indicated by means of cords crossing each other at determined distances, at right angles to each other, sharp wooden pickets being driven into the ground at the points where the lines intersect each other.

When the hole is perfectly formed, and the loose earth has been again thrown in, the seeds, about twelve in number, are deposited at nearly equal distances asunder, and then lightly covered to the depth of half an inch or an inch with mould: it will be better every evening to sow the seeds in such holes as have been made during the day.

The weather is commonly showery at the usual period of sowing, and the seeds will in such case spring up in three or four days. The sowing may be performed in any one of the six months from November to April inclusive. It is better to finish it before rather than immediately after rain. If the seeds

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are placed too deep in the mould, they will be deprived of the atmospheric influence needful for their germination; and if too near the surface, a shower might easily wash them away. Should continued rains follow quickly upon the sowing, and the sprouts do not appear at the end of about a week, it may be considered that the seeds are rotted in the ground, and the sowing must be renewed as soon as the weather will permit.

When the shoots are three or four inches out of the ground, which will generally be the case in about a month after sowing, all the shoots, with the exception of three or four to each hole, should be pulled up by the hand. A careful weeding is then performed, and this operation must be repeated every month until the trees have attained their full growth. If the removal of the weeds be delayed until they produce their seeds, it will then be almost impossible to extirpate them. It is always advisable to carry the weeds out of the fields. Some persons heap them up about the roots of the cotton bushes, where they operate hurtfully by preventing the access of all moisture, and by offering a harbour to various insects. As the young plants would die if their fibrous roots were cut, and as it is hardly possible to avoid this if an ordinary iron hoe be used, the earlier weedings should be performed, either by the hand or with a wooden implement. At the end of the third month, and even earlier than this, when vegetation has proceeded rapidly, all the sprouts, except one, are drawn from each hole. In making this selection, of course that plant will be preserved which is the most vigorous, and should it be difficult to determine to which plant this description applies, then that one of them must remain, which being nearest to the centre of the hole, will the least interfere with those in its immediate vicinity.

When the remaining plant has attained the height of eighteen or twenty-four inches, it has been usual to remove its top by pinching it off with the fingers. The intention of this operation is to cause the tree to send forth a greater number of lateral branches. It appears very doubtful, whether more harm than good does not follow this operation. That intelligent and practical planter, Mr. Rohr, is decidedly op-

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posed to it, as tending to injure the tree, and diminish its produce. He is of opinion that this operation should never be performed until after one crop of cotton has been gathered, and the branches become dry and withered.

It is seldom that the perennial cotton-tree produces a full crop before the second year of its growth; and it generally remains productive from four to five years. The manner of its renewal is, not to replant the whole field at once, in a regular manner, but to sow seed in such spots as exhibit any deficiency, and this is called, "supplying a field of cotton." The state of the field, and particularly as to the healthiness of the plants, can best be ascertained at the time when the weeding is effected. In Guiana, the pruning of the perennial cotton trees, in the second year of their growth, is commenced some time between April and July, the exact period depending upon the state of the weather, and the indications which the trees afford of yielding more cotton during that season. The whole produce is most commonly gathered in by April; the following month is considered to be the fittest for pruning, and to perform this operation properly will occupy the whole strength of the plantation during four or five weeks: the fields must be weeded previous to its commencement.

In pruning the trees it is advisable to keep their height at about four feet, but this matter will depend somewhat upon the nature of the soil. One of the most essential circumstances in the whole course of cultivation is the careful eradication of weeds, and thorough hoeing must be regularly performed at least three times between the pruning and the gathering of the crop.

The blossoms are generally expected to appear about the end of July, or beginning of August, after which the pods form, not simultaneously, but in regular succession: the first of them will open in about six weeks from the first appearance of the blossom. These pods are usually egg-shaped, bearing from three to five longitudinal furrows: each is accompanied by its calyx at the base, and is divided into as many cells as it has furrows, every one containing from three to eight seeds enveloped by the substance, to obtain which the plant is cul-

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tivated. When the fruit is sufficiently matured, the pods open and exhibit their woolly contents in the form of locks of a brilliant whiteness: one of these locks is contained in each cell of the pod.

Some cotton may be ready for picking in September, but it rarely happens that any considerable quantity can be collected until after the middle of October, and the crop is not all got in until the end of December: this is called the first crop. After this time the planters look for more or less rain during two or three weeks, which causes the trees to vegetate luxuriantly and to put forth their blossoms anew, so that by the end of February the picking of cotton may be recommenced. This second crop generally lasts until the middle of April.

The same natural cause which incites the trees to vegetation, has an equally powerful effect in fostering weeds; so that the attention of the planter will needs be directed to weeding in the interval between the two crops. It must be borne in mind, however, that great inconvenience would accompany the weeding of the fields after the formation of the blossoms, which might be broken from the trees by the labourers in passing among them. Happily the tendency to the growth of weeds is not so great at this time as earlier, owing to the thick shade afforded to the ground by the leaves of the cotton tree.

The main hope of the grower is placed on the first crop, since the rain which ensues after Christmas, and a certain quantity of which is necessary to the proper growth and progress of the tree, may continue for a longer time than will suffice for that end; or a succession of high winds may be experienced, either of which events is highly prejudicial. In the latter case the blossoms will be blown from the trees, while the continuance of rain will either produce a like effect upon the pods, or will seriously injure the quality of the cotton, causing the seeds and wool to adhere together in a compact form, and in this manner preventing the bursting of the pods.

The period of collecting the crop varies in different climates, and also according to the species or variety of the plant under culture. The particulars just given must be taken to apply to the perennial tree as cultivated in Guiana.

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With some varieties it is hazardous to defer the gathering of the wool for many days after the first bursting of the pods, to which the former often adheres very slightly. Where other varieties are grown the wool of which adheres more firmly, a greater delay may be used without prejudice, and the labour of gathering will thus be somewhat diminished. The appearance of a cotton field while the pods are progressively opening is highly interesting, the fine dark green of the leaf contrasting beautifully with the brilliant white of the cotton suspended from the pods, and floating to and fro at the bidding of the wind. It is usual to employ women and young people for collecting the crop, the labour being light and suited to their smaller degree of strength. The gatherers go into the field with baskets or bags suspended from their shoulders, for the reception of such part of the wool as they find sufficiently matured. In this operation they leave the pod attached to the tree, withdrawing from it the cotton with its seeds, which are deposited together in the bag.

In some parts of the East a different practice is followed, and the whole pod is gathered; but this course is unfavourable to the proper cleansing of the cotton, some portions of the dried pod becoming entangled with the filaments, and passing with them through the cylinders, which are employed to separate the seed. The after process of picking is by such means rendered more difficult and expensive; it will indeed be hardly possible to free the wool entirely from the smaller particles of husk, so that the marketable value of the cotton will be much diminished. Besides this, if the cotton should be at all damp when gathered, it will be much more difficult to dry it with the shell, than when separated from it. It is quite as easy an operation to remove the wool from the pod as it is to gather the whole together, provided the pods are completely opened, and if they have not yet arrived at this stage, it is improper to gather the cotton.

In going through the fields, some locks of cotton will generally be found on the ground; these of course must be collected also; but as they will have become more or less soiled by their contact with the earth, and as the clean locks would

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have their value diminished by the mixture, they must be kept wholly apart. Some planters direct the pickers to neglect these fallen locks until after those which continue to adhere are gathered, the field is then again gone through for their collection. By this course all chance of mixture is avoided. It will be proper in every case to shake the locks before they are deposited in the bag, in order to disengage any insects which may be adhering to the fibres.

Cotton should never be gathered while it is wet with rain. It will dry much sooner and more perfectly on the tree, than by any means that can be afterwards applied. If it is heaped together in a moist state, it will heat and become mouldy; the oil of the seeds will spread itself upon the wool and soil it, thus completely injuring its quality. It is better for these reasons, not to begin the gathering until the sun is sufficiently high to have evaporated the dew; and it is equally improper to continue this operation after the sun is gone down. The little time which would in fact be gained by such means, would poorly compensate for the damage to the quality of the produce.

It will be remembered that the cotton pods are not all developed at the same time, a circumstance which makes it necessary to go several times through a field during the period of the crop, in order to collect the locks as they come forward. The intervals between these gatherings differ according to the variety of the plant. In some cases the same field requires to be gone over by the pickers at the end of every four or five days, while with other varieties, a week, or even ten days may be allowed to elapse between each gathering. In any case, if too long a period is allowed to intervene, the filaments adhere so slightly to the pods, that they either fall or become the sport of the winds which scatter them about; so that if even they could be all collected, they would be deteriorated. Another reason for avoiding delay, is the probability that wet weather may set in, which would prove highly detrimental to the quality of the cotton. But if neither of these evils should be experienced—if the lock should still remain attached to the pod, and no rain should supervene, the quality of the cotton

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may be injured through the drying of the calyx, which being thus converted into a kind of dust, falls upon the cotton, and cannot afterwards be removed.

When the cotton is gathered, it must be exposed without delay to the heat of the sun, but sheltered from the access of dust; and this exposure must be repeated from day to day, until the seed is hardened. A wooden platform, or one of tiles is chosen for this purpose. If the weather is uniformly fine, an exposure for three successive days will be sufficient. The wool should never be thus exposed until after sun-rise, and it should always be conveyed under cover, before the sun goes down. Should the weather immediately after the gathering prove wet, such an exposure is of course impracticable. In this case, it is desirable to admit the air as freely as possible to the cotton, in order effectually to carry off the moisture; to facilitate which, it should be spread in thin layers and occasionally turned, that the air may exert its full effect upon the whole in turn.

This drying of the wool is needed, not only to prevent its heating and spoiling, but also to facilitate the separation of the seeds, which adhere much more strongly to the fibres when moist, than after they are perfectly dry. Were this not the case, it would save some time to separate the seeds from the locks immediately upon their being gathered, but were the planter to attempt this course, the moist and soft seeds would be flattened and crushed by the cylinders, and in this state would pass between them with the cotton, giving out their oil to the filaments, which would be much injured by that means.

The process of removing the seeds from the wool could perhaps be most perfectly done by hand, but the progress thus made would be so slow, and the quantity cleansed by the daily labour of one person so small, that the expence would be out of all proportion to the value of the picked cotton. Accordingly the planters have always been accustomed to employ machinery for the purpose, and this, until a comparatively recent period, has uniformly been of the very simplest construction. In China, and for some time after the cultivation of cotton was commenced by the planters of Georgia, the in-

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strument employed for the removal of the seeds, was an elastic stick with a string in the form of a bow. The string of this being raised by the hand and suddenly released, struck the cotton forcibly and opened the locks, so that it became an easy task to remove the seeds. This plan has long since been abandoned, as being tedious and inefficient; but the description of Georgia cotton to which it was applied, had, in consequence, acquired the name of *bowed* cotton, and this name has been retained, although the process has long been discontinued.

It is by no means considered as a settled point, whether irrigation is necessary or favourable to the cultivation of cotton. We have seen that a superabundance of moisture is prejudicial, and that where such a state of things is apprehended, sluices or drains must be provided to carry off the water and prevent its stagnating about the roots of the plants. In climates where mostly cotton cultivation is prosecuted, the operations of nature are usually witnessed in extremes. The storms of colder regions are aggravated into hurricanes within the tropics;—the shower of the former takes, in the latter, the form of a deluge—and, on the other hand, the few summer months during which the sluices of the sky sometimes continue shut up in temperate climes are, in the lower latitudes, as frequently prolonged to the most calamitous periods. Some degree of moisture is absolutely essential to the proper growth and fecundity of the cotton plant, and it would seem nearly as desirable, whenever the means can be obtained, to provide against the withering influence of drought, as it is to open a passage for the exuberant waters that under a contrary state of circumstances would disorder or destroy the plants.

The necessity of irrigation must be in a considerable degree dependent upon the nature of the soil. That which is sandy and light, will, of course, be sooner prejudiced by continued drought than land of more tenacious quality. If the weather at and after the time of sowing should be dry, the seed will remain inert within the ground, and will germinate only after moisture is supplied. In such a case it must needs be beneficial to possess the power of watering the land.

If nurseries are established for raising plants from seed, it is

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important, at the time when the sprouts are removed into the fields, to quicken the vegetation by means of moisture. In Guiana, where there are great facilities for irrigating the lands, they are frequently inundated with salt water; and, it is said, with very great advantage. At the same time, care is taken, by a system of draining, to prevent the permanent lodgement of any excess of moisture; and by means of these provisions, the cotton produced in that district has always proved of a most satisfactory quality.

The cotton plant is liable to many casualties, the chief of which has received the name of the blast, and is indeed the most serious evil that the planter has to encounter. Its more general cause is excessive moisture, which acts upon the plant in various ways. If the land be not properly drained and the wet should lodge about the roots, these will become rotted in the ground, and the plant will consequently droop and perish. Where the moisture is more generally diffused, that is, when the season is excessively rainy, and the land, notwithstanding the means employed for draining it, is constantly saturated with wet, an excess of vegetation ensues; a kind of vegetable plethora is experienced, and the fruit is destroyed. When the disease proceeds, as it sometimes does, from exhaustion of vegetation, and where from a long continuance of drought, the soil does not afford adequate nourishment, a state similar to that of gangrene follows; the whole plant puts on the appearance of having been scorched by fire, and is in danger of perishing; many of the blossoms fall unproductive, while the pods which are formed become black, their footstalks wither and rot, and the pods being no longer supported fall to the earth. When the disease has proceeded to this length, the trees are recovered with difficulty by means of careful pruning, and this only when aided by a favourable season.

So destructive is this disease occasionally found, that on a plantation which ordinarily yields 100,000 pounds of picked cotton, not more than 14,000 pounds have been gathered when attacked by the blast, and this scanty produce was of a quantity scarcely merchantable. It is a concomitant of this disease, that the plant is attacked by a peculiar kind of insect called

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the *cotton-bug* which infests the pods by swarms, and contributes greatly to the destruction of the crop: this, which is one of the effects, has sometimes been mistakenly considered as a cause of the blast. The insect, which is a species of *cimex*, is of a scarlet colour when young. If crushed when fully grown, a powerful and offensive smell will be perceived very similar to that given out under similar circumstances by its European and more domestic namesake. It must be evident from this description, that in the generality of cases, no care or skill on the part of the planter will prevent the attacks of this disease. Means for discharging all superfluous moisture should always be as far as possible provided, and the nutritive powers of the soil may in a great measure be restored by the application of manure; but against the inclemencies of seasons there can be no absolute security.

Another very serious peril to which the plant is liable, results from the ravages of an insect called the cotton caterpillar, but more generally known upon cotton plantations as the *chenille*. This destroyer is generally about an inch or an inch and a half long; its back and sides are of a glossy black; a single line of white runs down the whole length of the back at its middle, and double white lines are seen at each side of the single line and running in a direction parallel to it. The belly is of a whitish yellow colour, and is covered with a soft downy hair intermixed with bristles which are short and black. These insects have a most rapacious appetite; they sometimes appear singly or in small companies, but at other times are in such swarms, that whole fields of cotton plants which gave no sign of their presence on the previous evening, are seen in the morning to be completely devoured, so that not a leaf, a flower, a pod, or a green sprout remains.

A very singular effect accompanies the ravages of this little enemy. Although the insect itself gives out no smell, and the plants are equally inodorous, yet while the chenille is feeding on its leaves, a strong and uncommonly fragrant smell is perceptible at more than a hundred yards distance.

As soon as one field has been destroyed, the insect army marches away to another; but not always to the one nearest

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at hand, for, exhibiting an apparent capriciousness in their proceedings, they will pass over several fields unnoticed, and then suddenly, and by common consent attack another, which they will reduce to the same deplorable condition as the first; and in this manner they proceed, their numbers happily diminishing as they progressively pass to the state of chrysalides, for effecting which change they bury themselves in the soil. Another peculiarity in the habits of these caterpillars is, that they usually begin their ravages at the centre of a field, and it is only when their numbers are exceedingly great, that they attack at all parts, indiscriminately, and at once. They likewise choose preferably those plantations which afford them the completest shelter; so that one means of avoiding, or rather of lessening the chance of this evil, is to plant the trees at sufficient distances from each other. Another precaution, which is found useful, and the propriety of which, for other reasons than this, has already been much enforced, is to weed the ground thoroughly and frequently, which cannot be so well effected when the trees are planted closely.

These, however, are but palliatives,—the only certain remedy that has been proposed, is to submit the plants, when attacked, to fumigation with sulphurous vapours, and a simple plan has been suggested, whereby this specific could be used with ease and expedition. This plan is, for two persons to act in concert, one holding a chafing dish, with burning sulphur under the trees, while the other covers them with a canvas hood or cone, in order to confine the vapour. If applied in this manner, a very few minutes will suffice to destroy every caterpillar in the tree; and it has been calculated, that if two hundred people were thus set to work, with adequate apparatus, ten acres might be completely cleared of insects in the course of one day, at a comparatively trifling cost of money and labour.

It appears probable that another simple remedy, to which, on occasions of similar visitations, recourse is sometimes had in this country, might be found efficacious in destroying the chenille. This remedy consists in scattering finely powered quick lime over the leaves of the plant, while these are still

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moist with the morning dew. If the smallest particle of lime falls upon some descriptions of insects, they perish immediately; other kinds, indeed, as for instance the silk worm, are not at all injured by it; yet as the experiment may be very easily performed, there appears to be no good reason against its usefulness being put to the proof.

The destruction of the chenille is not, however, left entirely to the direct agency of man. Poultry of all kinds, and especially turkeys, will feed greedily upon this insect, and large broods of these birds are sometimes kept for the purpose. There is also another bird, the *piper aureola* of Linnæus, which, from a like predilection, has obtained the familiar name of the chenille bird; this appears at the same time with the insect, and disappears again with it: the number of the birds, as is said by very respectable authority, being proportionate to that of the insects which serve them as food.

The visits of the chenille seldom recur more frequently than once in three years; its whole existence is limited to twenty-seven days, nine of which it passes in the form of a moth.

Another description of caterpillar, hurtful to the cotton plant, is one which continues always either buried in, or crawling on the surface of the ground, it being incapable of climbing. The ravages of this insect are consequently at an end after the first week following the appearance of the plant above the ground. During this time it gnaws the stalk about half an inch from the surface, the seminal leaves are thus cut off and the plant perishes. If it escapes at this earliest stage of its developement, the leaves are placed out of the reach of the destroyer, and the stalk becomes too hard for its attacks. The ravages of these insects are said by Mr. Edwards to be so great, that it is necessary every third or fourth year, to resort to fresh land in order to avoid them.

Careful weeding is the best preservative against these caterpillars, which feed equally upon the cotton plants, and upon the spontaneous vegetation of the fields. If the latter is removed, as the insects are exceedingly voracious, they will probably quit or avoid a spot which does not supply their wants in sufficient abundance. It would appear that a perfect

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defence against the mischief occasioned by this caterpillar might be provided by raising plants from seed in the first instance in nursery grounds, since their growth, when fit to be planted out, would place them beyond the reach of the insect. In the meanwhile it would be easier to take precautions against its ravages in a nursery, than to guard the tender shoots over the whole surface of an extensive field.

Where nursery grounds are adopted, the soil chosen should be light and sandy, and the ground must be well pulverized previous to sowing the seed. The fibrous roots of these young shoots are exceedingly tender, and it is of importance to their future growth, that they should be uninjured; great gentleness must therefore be used in removing them from the soil. The same caution is necessary even when the plants removed are destroyed, as the fibres of those which remain might be injured through any violence used in removing others.

No greater number of plants should be taken up at one time than can be speedily replanted. To prepare a field for the reception of these plants, it should be previously subjected to thorough ploughing or digging.

The actual planting may be executed in various ways, either by tracing deep furrows with a plough, or by making holes with a hoe, or with a dibble. The depth of the furrows or holes should in either case be sufficient to admit the entire length of the roots. On depositing the plant, the soil around them should be gently pressed down with the foot, that it may be brought in contact with the roots, and that the evaporation of moisture may be retarded; if at all practicable, it were wise at this time to water the plants.

Cords may be used in planting out the sprouts, to mark their situations, in the same manner as is usual for holeing the ground when seed is sown; and this will be useful for preserving regularity in the distances between the plants.

Another advantage that would attend the employment of nursery grounds is, that some part of the plantation might be chosen for it which offered the means for irrigating, a practice which might be advantageously employed if the season should prove dry, in order to promote the first vegetation of the seeds.

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It would be desirable to make the nursery sufficiently large to supply two plants to every hole, the least promising of which might be removed in a few weeks after its transplantation, or at the first weeding of the field. It is evident that no loss to the cultivator need occur by this proceeding, as in planting out the sprouts a sufficient number may be left in the nursery ground to become productive bearers.

There is good evidence of the fact, that although the cotton-tree is indigenous to China, the ingenious inhabitants of that country remained, until a comparatively late period, ignorant of its value and unpractised in the conversion of its produce. We should otherwise hardly have been told, as a matter worthy of record, that the Emperor Ou-le, who ascended the throne in the year 502 of our era, was possessed of a cotton robe. Two hundred years after this time we find that the cotton shrub was cultivated in the gardens of Pekin, but only for the sake of its flowers as ornaments, and it was not until the eleventh century, that this plant was transferred for culture to the fields, and its produce rendered subservient to human uses. Cotton remained still neglected as an object of cultivation until the end of the thirteenth century.

It forms an uncommon circumstance in the annals of the Chinese, that the use of a substance introduced at so comparatively recent a date, has been allowed to extend itself so widely among them; and it offers an unanswerable proof, if any such were wanting, of the great value of cotton, that it has made its way in spite of the prejudices of a people, perhaps more inveterately attached to ancient usages than any other race of men. It is said, there is not one man in ten now to be found throughout that vast and densely populated empire, who does not in some measure clothe himself in cotton garments.

The Chinese possess both the cotton-tree and the herbaceous cotton plant. These are cultivated to a very great extent in different parts of that vast empire, yet its produce is not in sufficient abundance to answer all the demands of the Chinese

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population, and very considerable supplies of cotton are drawn from India. The annual shipments of cotton-wool from the Presidency of Bombay to Canton has been stated at nearly forty millions of pounds.

The herbaceous cotton, which is the species principally cultivated in China, is usually raised in land of a medium quality, which is sandy and rather dry than otherwise. If the ground were too wet, the roots, as already mentioned, would rot and be worm-eaten. If too rich, the vegetation of the plants would be forced at the expence of its valuable produce.

When the Chinese cultivators wish to appropriate to the production of cotton land which is poor and approaching to sterility, they keep the field covered with water during the winter, which practice proves, they say, an admirable preparation for this kind of plant. They maintain that this inundation is as sure a means of amelioration to poor and dry lands, as draining is to such as have been subjected to a lengthened inundation.

It is customary in China to allow the cotton shrub to remain on the ground during three years, and in the fourth year to root it out and plant the land with grain. In some provinces a different course is pursued, and after two crops of cotton have been taken, two grain harvests are produced, and so on in succession : it is said that leguminous plants are never raised from land appropriated to cotton cultivation. Fields intended for this are prepared by three previous ploughings, the first of which is performed in the autumn, the second at the beginning of spring, and the third immediately before sowing the seed. These ploughings are held to be necessary in order to pulverize the earth, to destroy all weeds, and to expose in turn the different particles of the soil to the atmosphere, and the beneficial action of solar light and heat. The land is harrowed after each ploughing. Whatever manure may be thought necessary is applied before the last ploughing.

Some lands are naturally so well adapted for cotton cultivation as not to need any manuring, but these are mostly situated on the margins of rivers, which overflowing after great floods, or upon the melting of the snows, a deposit of mud

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enriches the fields and performs the office of manure. In other cases, the skill of the farmer is shown in properly proportioning the manure to the nature and condition of the soil. If this is left too poor, the plants would be so feeble as to be incapable of providing themselves sufficiently with roots against the season of drought, and the produce would prove both small in quantity and indifferent in quality. On the contrary, where land is too highly manured, the trees are too full of sap, they put forth an abundance of leaves and but few blossoms. In apportioning the due quantity of manure, the planter is governed by the number of plants which he intends to produce upon a given breadth of land, it being evident, that a richer soil is required for the nourishment of three than of two plants in the same space. A practice the contrary of this is followed in many places, and where the soil is too poor to produce a luxuriant vegetation, and a greater number of trees may be placed in a given space without incommoding each other, the spaces usually left between them are contracted accordingly; a course which it would be difficult to justify upon any ordinary principle of reasoning, for surely the soil which refuses properly to nourish a small number of plants, must be still less capable of maturing a greater number.

The planters in China are not provided with much live stock, and manure of the description most generally used in European countries, is for this reason not easily procurable. The kind most generally employed, is either mud taken from the bottoms of rivers, or ashes, or the cakes left after the expression of oil from vegetable substances, and which are broken and spread upon the land, or night-soil. The first of these is in the highest estimation of all manures for cotton cultivation. As the mud is clammy and tenacious, it must either be dried and broken before it is distributed, or liquified by the addition of water, in order to spread it evenly over the surface. All kinds of ashes are thought to form a good dressing for the soil. Reeds, rushes, weeds, leaves, everything in fact which proceeds from the earth, is held by the Chinese to be fertilizing after being passed through the fire. The ashes most esteemed, however, are those furnished by the roots, leaves

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and pods of cotton plants of the preceding year. These are collected together in the field and then burnt previous to the sowing. This operation is always performed in the spring, so that the plants may be far enough advanced to resist the summer heats, and that they may attain their full growth by the commencement of July.

If at the time of sowing the soil appears drier than is suitable, and opportunity is wanting for watering it, the seed itself is soaked previously to its committal to the ground. Some cultivators leave the grains in cold water until they swell, others throw warm water over them, and keep stirring the whole until the water is cold. In either case the seeds are afterwards mixed with ashes, by which means their surfaces are dried, and no longer adhering together they can be sown with greater facility. One advantage which is sure to follow the immersion of the seeds in water, is the means it affords of distinguishing all that are bad, and which, floating on the surface, can be readily separated.

Various methods of sowing are adopted in China. Some deposit the seed in furrows; others scatter it broadcast; while others again adopt the digging of holes at regular intervals. The last method being the most laborious, and requiring the longest time for its performance, is, perhaps, the least adopted, although doubtless the best, and especially when the season proves deficient in moisture. Whichever mode is followed, the land is always thoroughly broken up before the sowing, and the seed is afterwards covered by means of a heavy hurdle drawn by a horse and guided by a man, who adds to the efficiency of the hurdle by standing upon it.

Chinese cultivators are well persuaded of the importance of constant weeding, both because each plant supported by the soil must draw some part of its nourishment away from others, and because weeds offer additional allurement and cover for destructive insects.

When the plants are only two or three inches out of the ground, the first hoeing is given, and the operation is repeated every eight or ten days, until the bushes put forth their blossoms. One effect of these frequent weedings is to render the

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labour at each period so light that women and children may be employed in its performance. The advantage of these labours is as much insisted on by Chinese agriculturists, because of the continual turning up of the soil, as it is for the removal of weeds; and it is well worthy of remark, that the system of horse-hoeing husbandry, introduced into England by Mr. Tull, has been pursued in China for ages in this its most essential particular.

The upward growth of the plants is checked when they are about a foot high, by nipping off their tops. The intention of this operation is to force out a greater number of branches; these in their turn are similarly treated when their growth has proceeded to a certain extent, under the impression that they will then put forth a greater number of blossoms, and perfect a larger weight of cotton. With the same view some cultivators resort to the very doubtful practice of removing a portion of the leaves, thinking that the sap of the plant will then be more retained in the branches.

Many directions are given for the performance of these pruning operations. That which appears the most essential is the selection of a proper time for their execution. The weather should be dry, and the early part of the day chosen, that the heat of the sun may quickly dry up the wounds which the plants receive; otherwise they will suffer materially, their produce will be diminished, and the quality of their seeds will prove inferior.

The manner of gathering the cotton is very similar to that already described. Many hands are employed for the purpose, and these are generally females, who, beginning their task in the morning as soon as the dews are evaporated, go through a field in the course of a very few hours. Very short intervals are allowed between the gatherings, in order to lessen the loss by the shedding or blowing away of the wool from the pods, a casualty to which the cotton grown in China appears to be exceedingly liable.

In some of the northern provinces of the Empire, the gathering is not finished before the frosts appear, after which no more pods are expected to open on the bushes, and the whole

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are then gathered and exposed during the middle of the day to the heat of the sun. Cotton thus obtained is never comparable in quality with that which has been matured upon the trees; still it is applicable to some uses, and the produce of even those pods which still continue closed and must be opened by the hand, is considered to be worth that labour, and is converted into inferior coverlets, or a species of felt or wadding, which is spread upon couches.

Several of the wealthy and more careful cultivators provide means for irrigating their lands during seasons of drought, and the same provision equally answers for draining them when the rains are excessive; by which means the planters render themselves in a measure independent of the casualties of seasons.

The Chinese, who are great and systematic economists, do not allow any part of the cotton plant or its produce to be wasted. Its seeds are first made to yield oil, and are then employed as manure, to which latter purpose the branches, leaves, and pods are likewise applied, either after having been reduced to ashes, or by rotting them in the ground.

Both the shrub and the tree species of cotton are cultivated to a great extent in the Indian Islands. Of the first kind there are many varieties, differing in the duration of the plant, some being annual and others perennial — in the texture of the wool — in the quantity of this proportionately to the weight of the seeds, and in its colour.

The cotton produced in Kutung is reputed to be the finest of all; a fact which probably is more owing to local circumstances, than to any real and essential difference in the plant. Vast quantities of this article are raised in the kingdom of Celebes, in Timor, Mongarai, Lombok, Bali, and in the productive island of Java, which last, although probably the most improved of all, as respects its agriculture, yet yields the coarsest and least valuable description of cotton.

The cotton tree is found in Java, but is never cultivated for its produce. When planted, it is near to houses, or in gar-

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dens, for the agreeable shade which it yields, or as an object of beauty.

The chief cultivation of the shrub is carried on in upland districts, but the annual variety is sometimes sown in the dry season as a following crop to rice. After the first gathering of cotton from these plants, the field is again submerged by the rain, and they perish. When this course is adopted, the seed is sown at the end of June, and the produce gathered early in November: this practice is said to be peculiar to Java. A great quantity of the wool is taken off by the domestic manufactures of the island, but there is yet a considerable superabundance for exportation. Java cotton may be purchased from the cultivators after it is cleaned, at the rate of nine dollars per picul, or about three-pence sterling per pound. Its staple is weak, and the quality is altogether equal to that of ordinary Bombay cotton.

The cultivators of cotton in the southern states of the American union, confine their attention to such plants as are of annual growth. Three varieties are produced in Georgia, which State has become of late years the principal source of supply to Europe. One of these varieties, the *Nankin* cotton, bears the yellow wool of which the well-known cloths imported from China are made: this is produced in only a limited quantity. The produce of the next, which is distinguished in the country as *green-seed* cotton, is white. These two grow in the middle and upland districts, from the latter of which circumstances the white variety takes its name of upland cotton; it is also called short-staple cotton, and bears yet another name that of *bowed Georgia* cotton, which last designation it owes to the employment in former times of a bowstring for opening the locks preparatory to the removal of the seeds, in the manner already described. The third variety, distinguished in the country of its production by the black colour of its seeds, is better known in Europe as sea-island cotton: this is cultivated in the lower country near to the sea, and on several small, low islands near to the shore. The manner of its introduction into the United States is well explained in the following letter.

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"It is known to many that cotton was cultivated for domestic purposes from Virginia to Georgia, long anterior to the revolutionary war. Mr. Jefferson speaks of it in his notes on Virginia. Bertram speaks of it in his Travels as growing in Georgia, and I have understood that twenty-two acres were cultivated by a Colonel Dellegal, upon a small island near Savannah, before the revolution. But this was the *green-seed* or short-staple cotton. Two species of the same family then existed in this country, the real green-seed, and a low cotton resembling it in blossom, both being of a pale yellow, approaching to white; one with the seed covered with fuzz, the other with fuzz only on the end of the seed.

"To explore the first introduction of the short-staple cotton into this country, would now, in all probability, be impossible; but we may very well suppose it was by one of the southern proprietary governments and possibly from Turkey, the trade of which country with England was then of much higher consideration than it has subsequently become. Nor would it have escaped those proprietors, many of whom were enlightened men, that the climate of Asia Minor, where cotton grew abundantly, was analogous to the climates of the provinces south of Virginia.

"Just about the commencement of the revolutionary war, Sir Richard Arkwright had invented the spinning-jenny, and cotton spinning became a matter of deep interest. In England, cotton rose much in price; its various qualities attracted notice, and the world was searched for finer kinds. The island of Bourbon was alone found to produce them, and yet the Bourbon cotton greatly resembled in its growth our green-seed cotton, although it cannot be its parent plant, for all attempts at its naturalisation in Georgia (which were many and repeated) have failed. It gave blossoms, but was cut off by the frost in the fruit, nor would it rattoon or grow from the root the next year, in which too it resembles the green-seed cotton of our country. This is all I am able to say, and perhaps all that is necessary to be said of the short-staple cotton.

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"The sea-island cotton was introduced directly from the Bahama islands into Georgia. The revolutionary war that closed in 1783 had been a war, not less of opinion and of feeling, than of interest, and had torn asunder many of the relations of life, whether of blood or of friendship. England offered to the unhappy settlers of this country, who had followed her standard, a home but in two of her provinces. To the provincials of the north, she offered Nova Scotia; to the provincials of the south, the Bahama islands. Many of the former inhabitants of the Carolinas and Georgia passed over from Florida to the Bahamas with their slaves. But what could they cultivate? The rocky and arid soil of those islands could not grow sugar-cane; coffee would grow, but produced no fruit. There was one plant that would grow and produced abundantly; it was cotton. The seed, as I have been often informed by respectable gentlemen from the Bahamas, was in the first instance procured from a small island in the West Indies, celebrated for its cotton, called Anguilla. It was therefore, long after its introduction into this country, called Anguilla-seed.

"Cotton, as I have already stated, had taken a new value by the introduction of the spinning machines into England. The quality of the Bahama cotton was then considered among the best grown; new life and hope were imparted to a colony and a people, with whom even hope itself had been almost extinct. This first success, as is natural to the human mind, under whatever influence it may act, recalled the memory of the friends they had left behind them.

"The winter of 1786 brought several parcels of cotton-seed from the Bahamas to Georgia; among them (in distinct remembrance upon my mind) was a parcel to governor Jatnall in Georgia, from a near relation of his, then surveyor-general of the Bahamas; and another parcel at this same time was transmitted by Colonel Roger Kelsall (who was among the first, if not the *very first* successful grower of cotton) to my father, Mr. James Spalding, then residing on St. Simon's island, Georgia, who had been connected in business with Colonel Kelsall before the revolution. I have heard that

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Governor Jatnall, then a young man, gave his seed to Mr. Nicholas Turnbull, lately deceased, who cultivated it from that period successfully.

"I know my father planted his cotton-seed in the spring of 1787, upon the banks of a small rice field on St. Simon's island. The land was rich and warm, the cotton grew large and blossomed, but did not ripen to fruit; it however rattooned or grew from the roots the following year. The difficulty was *now over;* the cotton adapted itself to the climate, and every successive year from 1787, saw the long staple-cotton extending itself along the shores of Georgia, and into South Carolina, where an enlightened population, then engaged in the cultivation of indigo, readily adopted it. All the varieties of the long staple, or at least the germ of those varieties, came from that seed; differences of soil developed them, and differences of local situation are developing them every day. The same cotton-seed planted in one field will give quite a black and naked seed; while the same seed, planted upon another field, different in soil and situation, will be prone to run into large cotton with long boles or pods, and with seeds tufted at the ends with fuzz. I should have great doubts if there is any real difference in these apparent varieties of the long staple-cotton; but if there is, all who observe must know, that plants, where they have once intermingled their varieties, will require attention for a long series of years to disentangle them.

"Subsequently to 1787, as the cultivation of cotton extended and became profitable, every variety of the cotton that could be gleaned from the four quarters of the globe has been tried, but none of them but *one* has resulted in anything useful. Mr. James Hamilton, who formerly resided in Charleston, and who now resides in Philadelphia, was indefatigable in procuring seed, which he transmitted to his friend Mr. Cowper, of St. Simon's island. Mr. Cowper planted some acres of Bourbon cotton; it grew and blossomed, but did not ripen its fruit, and perished in the winter.

"Mr. Hamilton sent a cotton from Siam; it grew large, was of a rich purple colour both in foliage and blossom, but perished also without ripening its fruit.

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"The Nankin cotton was introduced at an early period, the same that Secretary Crawfurd distributed the seed of some years back. It was abundant in produce, the seed fuzzy, and the wool of a dirty yellow colour, which would not bring even the price of the other short-staple cottons, but I knew it to produce three hundred weight to the acre on Jeykel island, in Georgia. The kidney-seed cotton—that is, a cotton which produces the seed all clustered together with a long strong staple extending from one side of the seeds, and which I believe to be the Brazilian or Pernambuco cotton, was tried, and was the only new species upon which there could have been any hesitancy; but this too was given up, because not as valuable, and not as productive. I have given the names of gentlemen, because I had no other means of establishing facts." Your very obedient Servant,

THOMAS SPALDING.

Darien, Georgia.

This Sea Island variety produces wool of a very fine, white, silky appearance, very strong, and of a long staple; it is very highly esteemed by the English manufacturers, and is bought by them at the highest price given for any cotton in our markets. It is said that the same variety is cultivated in Persia.

The greatest proportion of the land in the state of Georgia is known there by the name of *pine-barren*, and is a dry whitish sand. This soil abounds more particularly near to the coasts. Three, four, and sometimes even five crops may be taken from it without manuring.

The mode of culture employed in Georgia is, by means of temporary stakes to mark off squares, each side of which measures one hundred and five feet, equal in extent to a quarter of an acre. These divisions are laid off in ridges five feet apart. Weeding is considered as being of the very first importance in cotton husbandry in the United States. The first operation preparatory to the sowing is to hoe the land, in order to destroy all the weeds and grass, which are deposited in the furrows between the ridges: an able labourer will thus weed half an acre in a day, and this operation is called by them *listing*.

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The plough is next employed to divide the ridges, the mould composing which is thrown on either side so as to cover the weeds and convert the furrows into beds. These are afterwards levelled by persons who immediately follow the plough. Holes are then opened in the top of these beds eighteen inches apart, and of the width of the hoe employed in digging the soil. After this, another person deposits as many as twenty or thirty seeds in each hole, and two others follow who cover the seed with mould to the depth of an inch and a half, pressing it down, that the earth may be brought into contact with the seeds.

Scarcely is the sowing finished ere it is necessary to commence weeding, and this operation must be repeated at the end of every fortnight. When about a month has elapsed from the sowing, it is necessary to thin the plants, leaving about six or seven to each hole, and providing that these shall be as far apart as is practicable. At the next following hoeing a further thinning of the ground must be performed, and now only one or two plants are allowed to remain in each hole, the cultivator being guided on this point by the appearance of the plants and the nature of the soil. When the land is poor, it is usual to leave the greatest number of plants, in the expectation of making up by their aggregate number for the deficiency of their individual produce. When two plants are left in each hole, these must be as far from each other as can be managed; but where only one is left, it is desirable that this should be as near as possible to the centre of the hole in order to preserve uniformity in the general distances between the plants.

The cultivation of the annual cotton plant succeeds best upon sandy or gravelly soil, and the produce obtained from old land is usually greater than from fields recently brought under tillage. The usual, or it should rather be said, the universal practice in cotton plantations, in the state of Georgia, is to allot a certain amount of each kind of labour as equivalent to the daily task of an able-bodied labourer, allowing those slaves who get through their portion of toil early, to enjoy the remainder of the day according to their own pleasure, as a reward for their diligence. So common is this practice that the

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negroes consider themselves entitled to its continuance, and would remonstrate strongly, not only against its infraction, but also against any increase in the customary allotment of labour. In the practical operation of this system some negroes are considered as being *full* hands, others as *three-quarter* hands, others again as *half* hands, and the young and the feeble as only *quarter* hands; consequently, while the first are required to perform their full task, the others are expected to complete only three fourths, a half, or a quarter of that task respectively. Each individual has his or her class assigned at the commencement of the season. The young people who begin as quarter hands are gradually advanced in the scale according to their increasing bodily capabilities; while those whose strength is declining from their advanced age, or any other cause, are, on the other hand, released proportionally from their toil.

The following statement, given by Captain Hall, of the number of slaves maintained, and the amount of effective labour yielded by them upon a sea-island plantation, where two hundred acres are under cotton cultivation, will afford a very good illustration of this subject.

The whole number of negroes is - -	122	
Of these there are of men and women between the ages of 14 and 50 -	70	
Children under 14 - -	48	
Superannuated - -	4	
	—	122
Of the above 70 men and women, there are full hands	39	
Three quarter hands	16	
Half hands - -	11	
Quarter hands - -	4	
	—	70

So that the whole labour of the 122 slaves maintained, does not exceed that which would be obtained from the employment of fifty-seven and a half able bodied labourers, or, in the language of the country, taskables. Of these, a number equal to forty-four labour in the fields, while the services of the remaining thirteen and a half are required as artificers,

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house servants, herdsmen, carters, &c. Some of the forty-eight children are doubtless capable of undertaking light work, such as weeding and picking the cotton, but it is probable that what is gained in this way, does not more than make up for casualties and sickness among the older labourers.

In addition to the cultivation of cotton to the extent above mentioned, the slaves on this property are employed in raising Indian corn, and other articles of provisions, so that each of the forty-four taskables in the field, performs on the average an amount of labour equal to the cultivation of five acres of land; while if the expense of labour be reckoned, according to the number of persons maintained on the estate, only two acres can be considered as cultivated by each.

A plantation is considered capable of yielding one thousand pounds weight of merchantable cotton for each able-bodied labourer employed.

The crop generally begins early in September, but the pods will sometimes burst a little earlier than this. Women are usually employed to collect the produce, and are found more expert in this operation than men; a practised hand will gather daily from ninety to one hundred pounds weight of seed cotton, the seeds in which form about two thirds of the entire weight.

When brought in from the fields, the produce undergoes an examination, and is sorted into three divisions, according to its colour and other qualities; women, invalids, and old people are employed for the performance of this task. After this the cotton is dried with as little delay as possible, by spreading it out in thin layers during the hottest part of the day. If this process is delayed, the locks, as already mentioned, will become heated and spoilt, and besides this, it is essential for reasons which have also been given, to have them perfectly dry before any attempt is made at separating the seeds.

It has been calculated that the purchase of a tract of land in Georgia, suitable for cotton cultivation, and capable of yielding 30,000 pounds of cotton annually, together with the

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cost of thirty slaves, and the needful quantity of live stock, the erection of buildings &c., will require an outlay of about 21,000 dollars. Such an estate will usually comprise six hundred acres of land, only about a fourth part of which will at any one time be planted with cotton. The annual expences may be particularized as follows, viz.:

Overseer	400 dollars.
Carpenter	300 „
Clothing	300 „
Tools	100 „
Medicines	50 „
Bagging	125 „
Freight to market	100 „
Taxes	25 „
Making together	1400 dollars.

Or something under five cents—about twopence-halfpenny sterling money—per pound on the produce. In this estimate no charge is inserted for provisions, as it is presumed the negroes will grow sufficient for their own maintenance during the intervals from labour permitted by cotton cultivation; nor is any allowance made for wear and tear and casualties happening to the live stock, since, with ordinary attention, the natural increase of these should be adequate to replace all losses of this description.

This estimate differs very materially from statements that have been given of the expense of cultivation in the West Indies, which, it is said, amounts to seven-pence sterling for every pound of cotton sent to market. Making every allowance for the peculiar circumstances of each country, and also for the expense of maintaining and clothing the unproductive negroes on the plantation, of whom no account is made in the American estimate—it is yet difficult to imagine that the enormous difference in the cost of cultivation here mentioned is not, in a great measure, occasioned either by faulty modes of husbandry, or by the choice which our colonists make of a species of plant which is less productive than that propagated by the American citizens.

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Mr. Edwards, in his History of the West Indies,* states the expense of settling a cotton plantation in Jamaica, at very little more than that required for an estate of equal extent in Georgia, or Florida, including interest of money, and all the expence of feeding and clothing the negroes during the first year. Mr. Edwards, whose practical information upon such points will not be doubted, refuses to take any account of these as annual charges afterwards, "because the land in cotton not being sufficient to find them in full employment, they (the negroes) may raise corn and other articles more than sufficient to pay for their own support." On the other hand, Mr. Edwards estimates the average produce of cotton in Jamaica, at about one-half the weight per acre produced in Georgia, a deficiency which cannot be attributed to either soil or climate, and which deficiency would probably have been long since remedied by the substitution of some more productive species of the plant, joined to a better system of husbandry, had not the attention of the growers been altogether called away to the prosecution of a more profitable object. Now that the advantages attending sugar cultivation have in turn been diminished, the planters are not tempted by the recollection of former gains, to re-establish their cotton fields. At the time when Mr. Edwards wrote his history, the cotton grown in Jamaica was of a coarse description, and, owing to the brittleness of the seeds, was so difficult to be made perfectly clean, that it bore the lowest price of any cotton then brought to the English market, and sold at thirty per cent. below that imported from Demerara, "Such however," he adds, "is the obstinacy of habit, that few of the British cotton planters give themselves the trouble to select a better sort, or seem even to wish for it." The colonists of that day have, however, been succeeded by a more intelligent race of men, who do not close their eyes against the knowledge of improvements, nor persist in courses whose antiquity is their sole recommendation.

There are many situations in our colonies, where the employment of a plough is impracticable, and where consequently the American system of husbandry cannot be followed, so

* Vol. ii. p. 312, 4to Edition.

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great would be the labour of annually holeing the fields. Where this difficulty does not present itself, the propagation of the annual black-seeded shrub appears to offer the greatest inducements, not only on account of the superior quality of the wool, but because it presents means for avoiding the ravages of the grub, by continually changing the land under cultivation.

The cultivation of cotton in the United States of America, is a pursuit of modern introduction. So lately as the year 1791, at which time no domestic manufacturers were established in the country, the whole quantity exported thence amounted to no more than sixty-four bags, of three hundred pounds each. To such an extent is this branch of husbandry now carried, however, that the exportation of cotton from the States, amounts on an average to 720,000 bags annually, in addition to 130,000 bags retained for the employment of their own looms. Of these exports, considerably more than half a million of bags find their way annually to Great Britain, whose spinning mills and looms absorb yet additional supplies, amounting to between two and three hundred thousand bags, the growth of Brazil, the East and West Indies, and latterly of Egypt.

Vast as these quantities appear, and are, the rate of progression by which they have arrived at their present amount, has been so steady, and at the same time so rapid, that we can hardly doubt of its continuance, or consider it beyond probability that ere another half-century shall have elapsed, even our present importations will be made to appear comparatively insignificant.

It may not prove uninteresting or useless, if a short detail is here given of the judicious and persevering efforts made by Mr. Andrew Bennet, a cotton planter of Tobago, about half a century ago, with the view of improving the general quality of his produce. This detail is taken from the recorded tranactions of the Society for the Encouragement of Arts, &c. whose gold medal was bestowed on Mr. Bennet, to mark its approval of his exertions. If every improver would candidly relate, as this gentleman has done, his various efforts—recording his failures as well as successes—how materially would

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difficulties be removed for succeeding experimenters — how much time might be saved and disappointment prevented!

Mr. Bennet procured his first seed from Barbados, and was so much surprised and mortified at the great variety of qualities of which his crop was composed that he was induced to think the seed had been collected from every cotton plantation in Barbados, and he sent to another island for a fresh supply. Nearly as great a variety of qualities was produced in this case also; and he thence found the necessity of selecting the pods of such trees as produced the finest cotton, in order to procure a supply of seed that would prove more even in its produce.

By adopting this plan, the quality of his crop was much improved the following year. After gathering this second harvest, a part of his trees were cut down and left to sprout afresh; but by this proceeding, the crop of the succeeding or third season was much lessened, the particular varieties which he had chosen, not being adapted to this mode of culture. So far, then, all that he had gained was knowledge and experience, but availing himself of these, Mr. Bennet proceeded to examine almost every cotton-tree upon his land; and not content even with this, collected seeds from some of the best plants he could find upon neighbouring estates, sorting the whole as well as he was able, and planting each sort by itself.

In the course of his search, he discovered part of a lock of cotton, which appeared to be excellent. The seeds in this he likewise planted in a particular spot, apart from any others, and gave them every advantage that could result from the most careful culture. Their produce was great, and promised so satisfactorily, that in the following year he sowed seven or eight acres with the seed, but was again disappointed, for the produce proved very scanty, and a great proportion of the trees died. Besides this, the wool was of a quality that could with difficulty be cleared from its seeds, and for these reasons he resolved to abandon the cultivation of this variety.

It was an additional incitement to this course, that his careful selections of the two preceding years, had brought Mr. Bennet acquainted with other sorts nearly as promising in

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appearance, and which proved to be free from this objection just mentioned.

"Still aiming at perfection," his search was continued from day to day, and at length one sort was discovered which bore very large pods, ninety of which on an average, and eighty if they were selected from among the largest, weighed one pound. This kind, from its size and peculiar bold appearance, he called the *Bull-head.* The wool of this was not fine in quality, being classed as a middling common cotton, so that the favour with which it was viewed arose entirely from the abundance of its produce. About the same time another variety which promised a favourable result was observed and selected. The pods of this, which he called Guava cotton, were large, one hundred and ten of them weighing a pound. On comparing the produce of these two kinds, he found that there was little if any difference in their quantity, the greater number of pods on the one making up for the greater weight of cotton in those of the other. From one tree, three years old, Mr. Bennet gathered four pounds and a half of cotton: in this case, one hundred and forty pods were required to make up a pound. This persevering agriculturist winds up the statement whence these details are drawn, with this remark:—"I have hitherto gained some new insight every year, and see clearly, that there is an hundred times more to be learned about cotton than its planters imagine."

At the time these experiments were prosecuted, an evil existed which has since been in a great degree remedied. The imperfect nature of the only instrument then in use for separating the seeds from cotton, or as it is termed, *ginning* it, made it necessary to avoid the cultivation of kinds, the fibres of which adhere tenaciously to the seeds, although such kinds are found among the very finest varieties both in regard to texture and colour.

It is to be regretted that in his slight description of the varieties he observed, Mr. Bennet made use of arbitrary names which convey but little definite information to others. The record of his labours is unaccompanied by any botanical explanations whereby the varieties can be recognized, and those

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labours are thus in a great measure without the advantages which they might have yielded to succeeding cultivators.

He particularly noticed three species of cotton plants on his estate in Tobago, as being sufficiently distinct from each other to entitle them to receive different names. One he called silk cotton, another vine cotton, and the third broad-lock; by which particular names it is probable they are only locally known.

Of the first kind he states there are about twenty sorts, all more or less of a fine quality, and long staple, and producing abundantly, but most of them difficult to be cleaned, in consequence of a kind of green moss which closely envelopes the seeds, and which, mixing with the cotton in the operation of ginning, lessens its value in the market.

The varieties of the vine cotton are even more numerous than the foregoing, as many as forty or fifty having been observed. The quality of their produce is not equal to silk cotton, and the locks are very apt to fall from the trees as soon as they open. The wool is easily cleaned, the seeds being free from moss, and the filaments adhering but slightly to them. This is doubtles the species described as *gossypium vitifolium.*

The pods of broad-lock cotton are large, and the quality is good. The peculiarity whereby this species is distinguished from all others is this, that when the pods open, their wool does not hang down, but adheres to the sides of the pod and spreads out broadly from it, loosening itself gradually as the pod grows dry; but even then the cotton will adhere sufficiently to a part of the pod to prevent its falling, which it will not begin to do until eight or ten days have elapsed.

The machine employed for separating the seeds from cotton wool is called a gin. Until a recent period, this implement was of the very simplest construction, being composed of two hard-wood cylindrical rollers, each about an inch in diameter, and furnished with five or six longitudinal grooves or flutings. These rollers were placed horizontally one over the other, almost in contact, one end of each being fixed into the centre of

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a fly wheel thirty inches in diameter, two of these wheels being attached to the gin for this purpose, one at each side. The wheel bearing the upper cylinder was at rather a higher level than that which bears the other, and both were caused to revolve by means of a foot-board, similar to that of a common turning lathe, motion being thus given to two straps or cranks, one attached to the exterior of each fly-wheel, at a point somewhat removed from its centre. The person working at this gin employed his foot to set it in motion, while his hands were occupied in feeding the cylinders with cotton. This being engaged by the fluted rollers, was drawn between them through to the side beyond, leaving behind it the seeds which were too large to pass between the same opening.

With this simple machine, one person could with difficulty clean as much as thirty or forty pounds of cotton in a day; and even with preparing this moderate quantity, a man after working for two days became so fatigued as to require an equal interval of rest, so that the implement was wholly inadequate to the wants of an extensive plantation.

In the improvements which have been made in the construction of the gin, there has been no material departure from the principle. In fact, the apparatus employed for cleaning sea-island cotton, although its parts are multiplied, and horse or water power is used to work it, is similar in every respect to the roller-gin already described, except that it is provided with the addition of a kind of rugged comb, having teeth two inches long and about two thirds of an inch apart, with sharp points. This comb, which is placed parallel to the rollers along their whole length and nearly in contact with them, is kept constantly and rapidly moving up and down, so that the sharp teeth being engaged with the locks of cotton, tear them asunder in their passage to the cylinders, and thus facilitate the separation of the seeds. It is an inconvenience found to attend the use of this comb, that its teeth coming too directly and violently in contact with the seeds, they are sometimes broken into small pieces, and in this state will pass with the wool through the cylinders. These particles, together with all other foreign matters which may still be included in the

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wool, and all discoloured portions must afterwards be carefully removed by hand picking, and this process is called *moting*. An industrious hand will mote from twenty-five to thirty pounds of cotton in a day.

Steel cylinders and metallic turned bearings, are sometimes used in the construction of these roller gins. These are more expensive than wood, but besides that machines thus constructed are more durable, they are made to perform the work with greater precision and less waste of labour. It is said too, that the cotton, in passing through, acquires a lustre which gives it an additional value, at least in appearance. The angular edges of the grooves, or flutings, in the cylinders must be rounded off, or they would cut the cotton. If metallic cylinders are used in the West Indies, care must be taken to preserve them from rust, to which from the dampness of the climate they will be greatly liable, and which would soil the cotton, and so lower its marketable value. Machines of this kind have been put to work in the United States which are capable of cleaning, each, from eight hundred to one thousand pounds of cotton in a day.

A different and a much more efficient apparatus is employed for cleaning short staple-cotton, which, unlike the Sea-island variety, is improved rather than deteriorated by its means. This implement is appropriately called a saw-gin, and consists of one roller, nine inches in diameter, having a series of circular saws fixed upon it, parallel to each other, and at a distance of one inch and a half apart. Above this cylinder there is a hopper, wherein the cotton to be cleaned is placed. The bottom of this hopper is formed of a grating of wire work, through which the teeth of the circular saws project to a certain depth. When first invented, instead of saws, the cylinder was covered with wires, standing out from it like the teeth of cards, upon which the saws certainly form a great improvement.

When the cylinder is put into rapid motion, the projecting teeth of the saws engage themselves with the cotton, tear open the locks, and drag the filament through the wire bottom of the hopper, which being inclined at a considerable angle, the seeds as they are disengaged roll down and are conveyed away through a kind of spout at the side of the machine. The fibres

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of cotton are afterwards disengaged from the teeth of the saws, by means of a cylindrical brush connected by a wheel and pinion with the axis of the cylinder, and made to revolve with considerable velocity, With one of these saw gins, an industrious person will clean three hundred weight of cotton in a day.

The following statement exhibits the importation of cotton-wool into Great Britain, together with the quantities re-exported and taken for home use during the last five years :—

Total number of packages—	1827.	1828.	1829.	1830.	1831.
Imported	892,535	749,588	747,449	871,908	905,200
Exported	75,300	64,900	109,300	35,450	80,800
Taken for Consumption	707,500	731,030	754,660	805,580	870,000

GOSSYPIUM, ARBOREUM — TREE, LEAF, AND FLOWER.

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COFFEE.

Coffea Arabica, or *Jasminum Arabicum* — a genus of the *Pentendria* order, belonging to the *Monogynia* class of plants, and ranking in the natural method under the order of *Rubiaceæ*.

ARABIA is generally supposed to have been the native region of the coffee tree. There is, however, reason to believe, that it passed into that country from Persia, whose inhabitants had themselves received it from Ethiopia, where the people had made use of its fruit from time immemorial. Its introduction to other parts of the East and elsewhere, and, as regards Europeans, the knowledge even of its fruit, date from periods sufficiently recent for them to fall within the authentic records of history, so that we are at no loss in assigning the dates and occasions of its extension to different countries, while, in many cases, we are acquainted even with the names of persons who have been instrumental to that end.

There is one point with respect to coffee as an article of consumption, which, it is true, has not only never been satisfactorily cleared up, but as to which not even a reasonable conjecture has ever been hazarded. How did men first arrive at a knowledge of the fact, that this berry, the pulp of which is rejected as useless, and whose seeds, guarded further by an equally unprofitable integument, are, in their natural

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state, nauseous and unpromising, can, nevertheless, be rendered, on their incipient destruction by fire, in a high degree grateful and exhilarating? The often repeated tale of the effects observed to follow the eating of the leaves of coffee trees by a flock of goats, does not in any way clear up the difficulty. This enquiry, as it involves a question of curiosity rather than utility, we may, however, pass over without much regret; and, satisfied with the enjoyment which the discovery has placed within our reach, be content to remain in ignorance as to how that discovery was first brought about.

The use of coffee, as an alimentary substance, is now become so general throughout the civilized world, that the modes of its cultivation must needs be an object of great and even universal interest. Within the last few years the extension of its use in England has proceeded with a rapidity which is surprising; having advanced, since the commencement of the present century, from an annual consumption of about 250 tons to forty times that quantity. The consumption of the kingdom in the year 1831 reached 9865 tons, or upwards of twenty-two millions of pounds weight. Nor is this increase peculiar to Great Britain alone; — the rapidly augmenting population of the United States of America equally evince a growing taste for coffee, so that the importation of the article into that country has been nearly trebled within the last ten years, and is estimated to amount at this time to 20,000 tons, or rather more than double the quantity upon which the home consumption duty is paid in this kingdom. The cause of this increase is, in both cases, to be sought primarily and principally in the reductions made by the respective governments of England and America in the rate of duties chargeable on consumption; nor is there reason to suppose that much, if any, falling off in the quantities now used, will be experienced in either country, unless upon the reimposition of heavy duties, — a course which it is very little likely will be adopted. If, on the contrary, our present scale of duty is preserved, we may reasonably expect that, as the merits of the beverage become more known to the bulk of

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our population, its use will be progressively extended, until, as it has long done on the Continent of Europe, coffee, in a great measure, takes the place of tea, and comes to be considered among the indispensable wants of the people.

The cultivators of coffee have an advantage over the growers of sugar in the smaller outlay of capital required for the establishment of their plantations, and in the diminished quantum of labour which suffices for their cultivation, and for the preparation of their produce for shipment. They likewise enjoy another advantage in which few other cultivators participate. Should the markets for their produce be temporarily closed, or should the price be accidentally reduced below its natural level, the sale of their produce may be deferred to some more favourable period, without any loss being experienced through its diminution or deterioration, the quality of coffee being, on the contrary, materially improved by age; and if, which is, indeed, too generally the case, circumstances do not permit the planter to store up crop after crop, or to keep back his produce from sale even during the year of its growth, he is yet benefited by the imperishable nature of his property, since capitalists are thereby induced to make speculative purchases, and the price is thus prevented from reaching the extreme point of depression to which it might otherwise fall.

The migration of the coffee shrub from Arabia to the tropical regions of the West, was effected circuitously by way of Europe. About the year 1690, the then Governor of Batavia, Van Hoorn, procured some berries of the coffee tree from Mocha in Arabia Felix, and raised many plants in the Island of Java, whence he sent one to Nicholas Witsen, a Burgomaster of Amsterdam, and then Governor of the Dutch East India Company. This plant arrived in a healthy condition, and was placed in the Botanical Garden of Amsterdam, where, by careful management, it was made to bear seeds, and, in the course of a few years, many young plants were raised from its produce. This statement is given by the learned and accurate Boerhaave, in the second part of his "Index of the Leyden Garden."

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Many years elapsed, however, ere the progeny of the Amsterdam plant was conveyed to a more congenial climate, and where it could be rendered practically useful. It was not until the year 1718 that the colonists of Surinam began to form coffee plantations; and nearly ten years more had passed before the plant was conveyed by the French to their colony of Martinico. The advantages attending the cultivation were now, however, become so manifest, that it quickly spread throughout the neighbouring islands. In 1728, Sir Nicholas Laws first introduced the coffee plant into Jamaica, where it was cultivated on the estate since called Temple-Hall, in Liguanea. In four years after that period it had already proved itself of sufficient importance to command the attention of the legislature of that island: and an act of the council and assembly was passed to encourage its growth. In 1752, Jamaica already exported 60,000 pounds weight of coffee; and in 1775, the quantity was augmented to 440,000 pounds.

An impulse was given to coffee cultivation in the British colonies by the reduction of the import duty in 1808 from 1*s.* 6*d.* to 7*d.* per pound; and, by this measure, the revenue derived from the article was very nearly trebled. This fact did not, however, prevent the government, in more recent times, from imposing heavier duties on the consumption of this article; and it was subjected, in 1819, to the payment of one shilling per pound. Its use was, in consequence, for a long time principally confined to the wealthy classes in this country. In 1825 the duty was again lowered to sixpence per pound; so that the retail price has been brought more within the means of a larger class of persons, and the consumption throughout the kingdom has since increased to the comparatively large quantity already mentioned. The experiment now in course of trial with some other articles of consumption, the duties upon which have been either wholly removed or greatly modified, will afford good means for judging whether a still further reduction of the duty on coffee is practicable, consistently with the proper maintenance of the public revenue.

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The annual consumption of coffee in Europe has been estimated to amount to 110,500 tons, or 247,520,000 pounds weight, which quantity is thus distributed: —

	Tons.	Pounds.
Great Britain - - - - -	10,000	22,400,000
Holland and Belgium - - -	40,000	89,600,000
Germany and countries round the Baltic - - - - - -	32,000	71,680,000
France, Spain, Italy, Turkey in Europe, the Levant, &c. - -	28,500	63,840,000
	110,500	247,520,000

It must be very difficult to arrive at any just conclusion upon this point of consumption, since coffee is an extremely active article of commerce, and passes with rapidity from one market to another, according as it is attracted by the fluctuation of prices, so that one original importation may subsequently go to swell the amount of yearly imports in various quarters. Some such consideration appears wanting to account for the circumstance that Holland and Belgium absorb so large a quantity as that assigned above, and which is one-fourth greater than the estimated consumption of all Germany and other countries round the Baltic sea, with the inhabitants of which coffee drinking is a general habit. Holland is necessarily made the entrepôt for the very considerable growth produced in her own dependencies; but there can be no doubt that a large part of these importations pass on to other countries for consumption: and it is not improbable that the recently adopted navigation law of France, forbidding the importation of goods from England, which are the produce of either Asia, Africa or America, may be the occasion of French merchants resorting to Holland for supplies which might otherwise be procured from this country.

The production of coffee was long considered of so much importance by the Dutch government in Java, that it was not only converted into a strict monopoly, but the native inhabitants were compelled to raise at least a certain number of plants. In the Sunda districts each family was obliged

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to plant and to take care of one thousand trees: and in the Eastern districts one half that number was prescribed as the smallest amount of cultivation. During the time when the English held possession of Java, their compulsory measures, together with the government monopoly, were abandoned, and the growth of coffee was by this means much encouraged. Sir Stamford Raffles has computed that towards the close of the British administration in Java, about eleven millions of young coffee trees were planted out in newly formed gardens. The general average produce of a coffee tree in that island is said not to exceed one Kati, which is equal to one pound and a quarter of English weight, although, in some situations, a considerably larger crop is gathered.

In Sumatra, owing to a want of care and skill in the management, the produce of their coffee trees had so degenerated as to be not worth cultivating, when, about the year 1800, a Mr. Campbell procured a few plants from Mocha, which he cultivated with complete success, gathering very abundant crops, the quality of which proved little, if any thing, inferior to the coffee of the parent country.

It is worthy of remark, as an evidence of the activity with which commerce is carried on in modern times, that the entire stock in the different markets of Europe of an article of such general consumption as coffee, and which is brought from distant quarters of the globe, seldom exceeds six months' average consumption, and is frequently much below even that proportion.

The coffee tree, or shrub, is an evergreen plant of a quick growth. It has a reddish, fibrous, tap-root, which shoots perpendicularly into the soil. In Arabia the tree sometimes grows to the height of thirty feet and upwards, having a straight stem or trunk, the diameter of which rarely exceeds four to five inches. The tree is far from attaining so considerable a size in our western colonies, where it rarely grows to so great a height as eighteen or twenty feet. Horizontal branches proceed from opposite sides of the trunk; they are nearly cylindrical, knotted at intervals, and covered, as well as the trunk, with a fine bark of a greyish colour: its wood is soft and elastic.

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COFFEA ARABICA.

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The form of the leaf is that of an elongated oval, pointed at the top and narrowed at the base, and having a short foot-stalk. The colour is a bright green, smooth and shining on its upper surface, and very much resembling the leaves of the common laurel. The largest leaves are two inches wide in their widest part, and four or five inches long. They grow in pairs on opposite sides of the branches, and from the axillæ of most of them proceed small groups of flowers to the number of four or five, each supported by a short pedicle. These blossoms are white; each is formed by a single petal, and both in form and size very much resembling the Spanish jasmine; they have a sweet and agreeable odour; and the trees, when covered with blossoms, form very pleasing objects. They continue in their full beauty only during two or three days.

The flowering lasts, in a certain degree, nearly all the year round, although the blossoms do not come forth in any great numbers, except at the two periods of spring and autumn. The berry, when first disclosed by the falling of the flower, is of a light green colour; so many of them frequently grow from the same spot, and press so closely upon each other, that it is not possible for them all to ripen together; and they must, in consequence, be gathered at different periods. In its progress towards maturity, the fruit grows first white, then yellow, afterwards reddish, then of a fine bright red, and at length, when fully ripe, the berries are of a very deep red. In this state they so nearly resemble the cherries cultivated in Europe, that if put among the last mentioned fruit, it would require examination both by taste and smell, as well as by the eye, in order to distinguish between them. The pulp, which is covered with a thin, soft skin, is as juicy as that of the cherry, bnt the juice is mucilaginous or slimy, and its flavour insipid and sweetish. The fleshy matter which forms the fruit, incloses two slender shells, which are hard and of an oval shape; the sides nearest to each other are flat, while the outer sides are convex. Each of these shells, which from an apparent similarity to that substance, has been called by planters *the parchment*, encloses a seed which is of a hard and somewhat horny consistence. These

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seeds form the article known in commerce as coffee; they are either oval or roundish in shape, furrowed on their flat side, and through their longest diameter, with a deep line. If one of these seeds should become abortive while the fruit is coming to maturity, the remaining one becomes larger and occupies the middle of the berry, while the furrowed side loses its flat form. This accident is seen to occur more frequently with the coffee we procure from Arabia than in that which we obtain from our Western colonies. The seeds differ in their colour, form and odour, according to the country of their production, and the processes used in preparing them for a market, so that coffee dealers of any experience are able, upon the most cursory inspection, to distinguish the native region whence any sample has been imported.

Coffee cannot be cultivated in any climate which is liable to the visitation of frost, so that it will not succeed except within, or at a very short distance without, the tropics.

The plants will grow in any soil, provided it is sufficiently light, or has been worked so as to allow the roots to penetrate without difficulty. They will sometimes succeed in spots whose degree of fertility is too small to admit of any other culture, and no severe labour is called for during the progress of cultivation. Where the soil is very rich, the vegetation of the trees will be exceedingly luxurious, but the fruit in such situations is never good in its quality. The most favourable situation for a coffee plantation is the side of a hill, exposed to the east, and where the earth is watered by occasional soft rains or refreshed by dews. Wherever coffee trees are planted on a plain which is exposed to the sun, other trees must be planted near to them to ward off its rays, which might otherwise injuriously hasten the maturity of the fruit.

Dr. Brown, in his "Natural History of Jamaica,"* describes the coffee plant as "a shrub which grows luxuriously, and rises frequently to the height of eight or nine feet, spreading its flexible branches to a considerable distance on every side. It thrives best in a rich soil, and a cool and shaded situation,

* Page 161.

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where it is refreshed with a moderate share of moisture. Under such circumstances, it generally produces so great a quantity of fruit that the branches can scarcely sustain the weight, and even the trunk is sometimes seen to yield to the load. The tree will grow and thrive in almost every soil about the mountains of Jamaica, and in even the driest spots has frequently produced very abundant crops. In Arabia, where the drought is frequently excessive, it is usual with the cultivators to refresh the roots of the trees with water, which is conveyed in channels throughout the plantations."

In clearing new land for the formation of a coffee plantation, it has been usual to burn on the spot all the brushwood and lesser branches of the trees which have been cut down, the policy of which measure is doubtful. The ashes which result from this burning, do, it is true, act as manure, by reason of the alkaline salt which they contain, but it may be questioned whether the baking of the earth which is thus occasioned, does not impair its natural fruitfulness; and it is certain that if the vegetable matter which is thus burnt, were allowed to decompose gradually on the ground, it would afford a much larger portion of serviceable manure. If this course is adopted, the quantity of branches should be collected and arranged in parallel rows, between which the coffee plants must be inserted. A further benefit to be derived from this arrangement, is the shelter that will be afforded to the plants in the earliest stages of their growth, and the obstacle which would be opposed to the washing away of the soil during the rainy seasons. The use now frequently made of the spaces between the plants for raising provisions, must of course be then foregone; and in first clearing land for a plantation, this may be an object of some importance, particularly where the number of labourers is limited. If, however, land suitable for provision grounds can be conveniently allotted elsewhere upon the estate, there are various reasons for recommending the planters to adopt that course at once, rather than to incur the disadvantages which accompany this double kind of cultivation.

The seed is sometimes sown at once in the spots where it is intended the trees shall remain, and at other times, planters

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adopt the use of nurseries. The most favourable seasons for sowing, are at the period of either equinox, or within the two months following. The autumnal equinox is chosen in countries on this side the equator, while beyond the line, the vernal equinox is considered the most favourable, since the young plants have not then in either case to encounter the fiercest heat of the climate, until their growth is sufficiently advanced to enable them to bear it without injury. If other seasons were chosen for sowing the seed, the young plants would probably perish as soon as they appeared above ground.

The advantages of sowing the seed in the spot which the trees are destined to occupy are, that the plants sooner arrive at maturity, and that they take a firmer hold of the ground than when transplanted, so that they will better withstand the violence of tropical winds. When this method is adopted, the exact spots where the seeds are deposited, are marked out at certain intervals by means of lines, which are either crossed by other lines, or marked with pieces of coloured cloth, at the distances which the plants should have between each other. At these places, or at the points of intersection where cross lines are used, holes are made by driving stakes, or piquets, sharpened at their lower ends, with a mallet into the ground; several seeds are dropt into each of these holes, which are then again filled in.

As soon as the plants have sprung up to the height of twelve or fifteen inches above the ground, all except that one which appears the most healthy and vigorous among them are pulled up.

The distance preserved between the rows is a point of some consequence, and must be determined according to the nature of the soil. It does not seem desirable under any circumstances, to plant them nearer to each other than nine feet. If the soil is good, the trees will grow so luxuriously that they might crowd each other, and prevent a proper circulation of air, by which means they would be rendered unproductive. If the soil should be poor and exhausted, so that this inconvenience is not to be expected, it appears equally injudicious to plant closely, since by that means, the inadequate quantity

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of nutriment which can be appropriated by each tree, will be still further diminished. In very rich soils, it will be better to allow the space of twelve feet to intervene between the rows, and between the trees in each row: it is usual to adopt the quincunx form in laying out a coffee plantation.

When the use of nurseries is adopted, the spots chosen for these are dry and open, having the soil of a medium quality. The ground is prepared by frequent working, and is laid out in beds, divided by shallow furrows, seven or eight inches distant from each other. In these beds, recent seeds, from which the pulp has been removed, but being still clothed in their parchment covering, are sown three or four inches apart. The seeds should be fully ripe, and fresh gathered. Those which have fallen from the trees, rarely produce strong and healthy plants, and where the fruit has been dried up, or is stale, it is probable that the seeds will prove unfruitful. It is not adviseable to allow the seed to be unsown for more than a fortnight after being gathered, and during this time, it should be kept in a sheltered and airy place. It facilitates the operation of sowing, by preventing the adhesion of the seeds to each other, if they are previously well sprinkled with ashes.

The nursery ground should be carefully watered by hand, or where the extent of the plantation renders this mode inconvenient, by channels, through which the supply of water can be conducted and regulated. This is most necessary when the plants are very young, but must not by any means be done to excess. It is better to water the plants in the evening, because, in warm climates, the moisture has then an opportunity of diffusing itself, which would not occur if the heat of the sun were immediately employed in its evaporation.

In about a month after the sowing of the seeds, the plants generally appear above ground, and in nine or ten months thereafter, will be in a fit state for transplantation. This operation is generally performed in the coolest time of the year, when the circulation of the sap is at the lowest point. Some cultivators, in taking the plants from the ground, are careful to leave a considerable quantity of mould around the roots; a plan which fully repays the trouble which it occa-

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sions, by the greater certainty of success with which it is accompanied. If the soil to which they are transferred has any depth, the tap-root ought to be preserved. If, on the contrary, the soil is shallow, the tap-root should be cut short and to a point, at the moment of transplantation. It may then be able to penetrate the clay, or hard soil, at which it will arrive; otherwise it will spread itself about in the loosened top soil, and will be subject to the attack of worms.

The plan frequently adopted of placing four plants in each hole, is of very doubtful expediency. The reason given in favour of it is, that an opportunity may be had for choosing the strongest among the plants for preservation, while the other three are destroyed. Is it not, however, probable, that by consigning four plants together to one spot, the soil about them may be so exhausted, that no one of them will have the same chance for acquiring a vigorous growth, as if only one were deposited? Failure, in this latter case, would be soon observed, and might be remedied without difficulty from among the plants remaining in the nursery.

The mode of transplanting is exceedingly simple. The plant, with a sufficiency of earth around its roots, is to be inserted in the hole prepared for it, and this being filled up, the mould must be pressed around the plant on every side with the foot. The shortest possible time should be allowed to elapse, between the taking of the plants from the nursery and their being replanted.

No general or invariable rule can be given for the depth to which the holes should be dug, or for the distance to be preserved between the plants. Both circumstances are dependent, not only upon the nature and quality of the soil, but also, upon the degree of exposure to which it is subject, and the particular atmospheric variations to which it will probably be liable. In dry lands, and on declivities, the plants may be placed nearer together than would be proper in most localities, and in level and fertile countries. In newly cleared lands, large holes must be dug, because the soil is loaded with the fibrous roots of trees. These serve to support a multitude of white worms until the roots of the coffee plant is presented to them,

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when they in turn will be attacked, and the plant will necessarily perish. Laborie recommends the coffee planter to dig holes, nine or twelve inches in diameter, and fifteen or eighteen inches deep. Others condemn this practice altogether, and direct the cultivator to drive the picquet into the ground without any previous digging, contenting himself with enlarging the hole, thus formed, by working the picquet round and round, and simply throwing in some loose mould at the moment when the plant is inserted. This may be an expeditious method of cultivation, and it is certain that it calls for only a small application of labour; but except where the soil is naturally loose, it is not likely that the planter who should adopt it, would ultimately find any cause to be satisfied with his choice.

It is not adviseable to remove coffee plants from the nurseries until they are at the least from twelve to fifteen inches high, because they are then better qualified to bear the accidents attendant upon their removal. After they are committed to the ground, branches furnished with leaves should be placed over them, to shelter them for a time from the sun. At the end of a fortnight or three weeks, when the plants have fairly taken root, the sheltering branches may be removed, but the leaves must be left, that they may first keep cool, and afterwards manure the land.

For the first and second years after the sowing or planting of coffee, Indian corn, Angola peas, or any similar vegetable may be cultivated between the rows. The *palma Christi,* or castor oil plant, may also be raised in the intermediate spaces, but neither yams nor any kind of running vines should ever be planted between coffee rows, as they wind about the trees, become entangled in the branches, and produce considerable injury. From the manner in which the root of the coffee-tree strikes, the plants which have been mentioned will not deprive it of nourishment during the time mentioned, but on the contrary, by covering the ground, and by the working of the earth required for their cultivation, as well as by the manure into which the stalks and leaves are afterwards resolved, the soil will be benefited. After the second year, the growth of the coffee-

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trees will have become so considerable, that the soil will be not more than adequate for their support, and all subsidiary cultivation must be discontinued. As a substitute for the constant working of the soil which it occasioned, the ground must then be thoroughly hoed at intervals not longer than two, or at most three months, and all the weeds must be carefully pulled up. If these are heaped round the stems of the coffee-trees, it is better than removing them, since it not only causes a saving of labour, but the weeds themselves will be serviceable to the ground, first by their shelter, and afterwards by their decomposition.

In its progress towards maturity, the coffee-tree puts forth a large branch from the top which spreads itself over the other branches. In general this branch is exceedingly productive, but it is said to be likewise very exhausting, so much so as to have acquired for it among French planters the name of *branche gourmande*. The premature decay which is thus occasioned to the tree much more than counterbalances the advantages of a few years' extra produce, and in dry situations it is usual to prune away this branch. In moist and rich lands, which are capable of sustaining the tree under the continued exhaustion, the branch may be left with advantage. If any branches should at times be accidentally broken, they must be cut away with a sharp instrument and the wounded parts covered with moistened earth.

In tropical climates which are subject to the visitation of violent hurricanes, it is adviseable not to allow the trees to grow to any great height, and hence, in some colonies, the custom has become general of topping them when they have attained the growth of six feet. This plan is accompanied by a serious disadvantage. The lower branches will bend themselves towards the ground and become entangled by growing more thickly than is expedient; the blossoms and berries will not be sufficiently exposed to the influence of the solar light and heat, while on the other hand they will be constantly exposed to the action of vapours exhaled from the soil, an evil of no small account in countries where the rains fall with excessive violence, and are immediately succeeded by the

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rays of a scorching sun. Another objection that may be urged against this lopping of the trees, arises from the wounds to which they are continually subjected, by means of which the moisture of the tree is exhausted, the leaves turn to a yellow colour, and the fruit drops without ripening. When these circumstances are observed, the tree is immediately cut down to the ground, and although it will shoot up anew with great apparent strength, the repeated toppings to which it is again subjected, soon cause it to decay past recovery. The suckers which from time to time grow up from the roots must be carefully removed as often as they appear, since they tend much to destroy the tree, without in any way adding to its productiveness.

Trees which are carefully tended, and around which the ground has been kept free from weeds, will generally yield a small produce of coffee at the end of two years from the period of their being first planted. At this time the tree is usually about five feet high, of a pyramidal shape, and forms a very pretty object. In the fourth year it is commonly in full bearing, and it continues to produce fruit generally during fifteen or twenty years, and sometimes for double the last-mentioned period. Mr. Lowndes, an experienced coffee planter of Dominica, writing in 1806, and describing the state of a portion of land on his estate, says,—"At this period, forty years from that to which I can trace any knowledge of this coffee—although it was probably planted some seven, eight, or ten, years previous thereto—it exhibits an appearance of as much luxuriance and productiveness as any piece of coffee I know in the colony."

Old trees put forth fewer blossoms and mature less fruit than those which are young, but the quality of the coffee which they yield is always better, and its flavour more aromatic.

A plantation of coffee-trees is renewed by cutting them down to the ground, and selecting for preservation only the finest shoots which are then sent up from the roots or the trunks. The ultimate duration of a plantation depends much upon the care and skill with which its cultivation is conducted.

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The yielding of coffee-trees varies exceedingly, not amounting in some cases to so much as one pound of coffee annually for each tree, while others will produce year after year as much as four pounds of annual produce, and instances have been known where seven pounds of merchantable coffee have been gathered from one tree of five years' growth.

Coffee-trees are very frequently seen to die without any obvious cause. The mischief is sometimes so extensive that a whole plantation will be thus destroyed. This evil is occasioned by a little insect which has hence been named the *Coffee Fly*. The animal commits its ravages by means of two weapons toothed like saws, which proceed from its head, and with which it cuts a multitude of deep notches in the trees.

Another insect, to which planters have given the name of *the Grub*, is sometimes very injurious. In colour and appearance this little creature resembles a flake of snow. It makes use of a kind of trunk or proboscis, with which it is furnished, in order to pierce the young bark of the coffee-trees. All mischief arising from this insect may be easily averted by planting pine-apples between the rows of the trees, which the insect will immediately quit that it may feed upon the leaves of the pine-apple, of which it is immoderately fond.

Field rats are often very hurtful to coffee plantations. These animals climb the trees in order to feed upon the pulpy part of the cherries, allowing the seeds to fall to the ground. Wherever these rats make their appearance, the planters are accustomed to give a premium for the head of each one brought in by the negroes, who employ dogs in hunting them. It has been said that in some of the French colonies, the negroes will feed upon field rats, which grow to a considerable size. In confirmation of this assertion it has been related, that a coffee planter, when enumerating the advantages offered by his property which he was desirous of selling, mentioned the great number of rats which it harboured, and which formed a principal part of the food of his slaves. This circumstance must have been at best of very doubtful advantage, since the animals must themselves have been supported at the expense of the property. It is necessary to wage in-

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cessant war with these vermin, which otherwise will multiply their numbers with a frightful rapidity.

Coffee is known to be perfectly ripe by the berries becoming of a deep and rather brownish red: as soon as this is perceived, no time is to be lost in gathering them.

In Arabia, three several periods are employed for this purpose, but the most considerable quantity is obtained in the month of May. In order to insure that none but ripe berries shall be taken, it is the practice in that country to spread cloths beneath the trees, which are then shaken, so that all the berries which are in a fit state may be disengaged from the branches. These are collected in bags and carried to a building open to the air, where they are spread upon mats to dry. When this is thoroughly effected, the berries are passed under heavy wooden cylinders which break the shells; and when by this method the beans are deprived of their covering, the two portions in which they are naturally found are separated, in the manner we see them brought to market. They are then winnowed, much in the same manner as will be hereafter described, and placed in the sun to render them perfectly dry before they are packed for shipment. The gathering process is twice repeated at intervals, so that the cherries are disengaged from the trees in proportion as they ripen.

In the West Indies also, the coffee crop is gathered in at two or three different periods, but the plan of proceeding is different from that which has just been described. The negroes who are employed for the purpose, are each provided with a small basket, or a bag, with a stout wire or iron ring at its mouth to keep it constantly open, and this is slung round the neck in order to leave both hands at liberty. Holding then the branch of the tree with the left hand, they select from it the cherries which are ripe, and, picking them with the right hand, deposit them in the basket. In performing this operation, care must be taken not to injure the branches or to bruise the newly-formed buds which should expand themselves shortly after. All green or unripe cherries are left for future gatherings. When their baskets are full, they are emptied

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into other larger baskets placed in a central spot, and these are carried away, from time to time, to be emptied at the mill.

The materials from which these baskets are made will generally be found growing at no great distance from the plantation; and the elderly or disabled hands about the estate are usually employed in constructing them.

It is a common practice in some colonies to provide each picker with two baskets; the larger one of which is capable of holding as much as a diligent labourer will be likely to gather during the day, — a plan which operates as a check against the idle and lazy hands, whose delinquency might otherwise pass unnoticed.

The operation of picking coffee appears to be extremely simple; yet some hands will show a greater degree of expertness in performing it than others. In passing between the rows, the pickers collect the berries from the trees to their right and left; and as, by this course, it is not necessary to pass round a tree, or to reach through its branches to the opposite side, much injury is thus avoided.

Coffee crop usually begins about the middle of July, and becomes pretty general in the islands by the end of August or the beginning of September. As, about this period, there are frequent and heavy rains, to which, as well as to drippings from the trees, the negroes are necessarily much exposed, it should be considered a point of indispensable necessity by the planter to attend, at this time, particularly to the health of his people, and with this view to see that their clothing is in a proper state. In days which are decidedly wet, of course the picking operation must be suspended; but it will not be practicable for the planter to remain inactive on days which are merely showery.

By the end of October the greater part will be secured; and in the following month the crop will be concluded. When ripe fruit is plentiful upon the trees, an industrious hand will gather three bushels in a day, which, according to the general calculation, should yield thirty pounds, or ten pounds per bushel of cured coffee in a merchantable state.

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The first care of the planter, after the berries are gathered, should be to dry them, that the beans may be easily separated from the pulp. The plan most usually adopted for this purpose is to expose them, during some days, to the joint influence of the sun and the air, spread upon a kind of terrace, the surface of which is covered with cement, and which is sufficiently inclined to allow the moisture to drain off freely. The berries must be spread on this terrace in a thin layer; if they are heaped up, fermentation is very likely to ensue, and this would communicate to the coffee a sour and disagreeable flavour.

Some planters make use of a stove for drying the cherries, which method has several advantages;—it will answer equally well in every state of the weather, the operation will be more quickly and more perfectly performed, and some economy of labour will be produced; it will, besides, entirely prevent all risk of fermentation. In other cases the use of a mill has been adopted for removing the pulp while it is yet moist, and before there has been time for fermentation to ensue. This pulp, which in our colonies is used only as manure, is preserved in Arabia, and is converted by infusion into a drink, for the use not of the growers only, but of the inhabitants of the country generally, for which purpose it is made an object of traffic.

The taste of our colonists does not lead them to make the same use as the Arabians make of the pulpy part of coffee cherries. There is another purpose, however, to which this substance might be applied with a fair probability of advantage. If the pulp were removed from the seeds immediately upon the cherries being gathered, and without their being dried, it might then be easily placed in circumstances for bringing on a state of vinous fermentation; and if, when the whole reached a proper degree of attenuation it were distilled, there is reason for believing that such a quantity of spirit would be produced as would fully repay the expense and labour incurred in the processes.

The mill in which the husking of coffee is performed, is composed of two wooden cylinders, each about twelve inches dia-

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meter; they are covered with sheet copper, the surface of which has been roughened, so that it will perform the part of a grater. Above the cylinders a hopper is placed, and into this the coffee berries are thrown to feed the mill. The separation of the beans from the husks is very easily effected; both then fall together upon a wire sieve, which is made to form an inclined plane, down which the beans run, and are received into baskets at the bottom, while the dry and broken husks pass between the wires.

The coffee is next transferred to a vessel containing water, where it is allowed to remain until the next day; the object of this immersion being to soften the adherent gummy matter preparatory to the next operation of washing; in performing which the beans must be stirred briskly about in the water, until all the mucilaginous matter has been washed away. The form of the washing-vessels is not material; wooden troughs or casks, are used indifferently, and upon some considerable plantations large basins of masonry are constructed for the purpose. Any description or form of vessel will answer, which allows of the beans being well agitated. Such of them as are defective will then swim on the surface of the water, whence they must be removed by skimming. Although greatly inferior in quality, and unfit for exportation, these light beans are not altogether worthless, but will be kept by strict economists for common use on the plantation.

The next operation is to dry the coffee upon an inclined platform, which is either paved with smooth tiles, or well plastered with cement, and to which the rays of the sun have free access. The beans having been spread out in a thin layer upon this platform, must be frequently raked to facilitate the drying by exposing all in turn to the atmosphere. If the weather should be fine and clear, three or four days will suffice for the perfect drying. Of course the coffee must be placed under cover in the evening before it can be affected by dews, and also whenever rain is expected. On some plantations they have an excellent plan of providing frames with slides, upon which the drying is effected. By this means labour is economised, as the slides can be shut into the frames in a moment; the

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coffee will thus be perfectly sheltered, and may be as quickly and easily exposed again on the re-appearance of the sun. These frames are a decided improvement upon the old plan of the platforms. It may often happen, that while the greater part of the labourers belonging to the plantation are employed at a distance from the works, in the necessary labours of weeding or pruning, a threatening cloud will appear, and all must be suddenly summoned to house the coffee, when, by the simple arrangement that has been described, the whole business might be done as effectually, and much more speedily, by the few hands whose attendance is in every case required for stirring the coffee.

After the drying is satisfactorily completed, the coffee is laid up for some time in store. It must not be heaped together too thickly, and must be carefully turned over two or three times daily, and this must be particularly attended to when it is first stored.

A different plan for drying coffee is followed in Arabia. The planters there keep it for a long time exposed to the air, but sheltered alike from the sun and damp, and in this situation it is kept — constantly turning it over — for more than a year, before any means are taken for removing the pellicle or parchment covering of the beans.

To divest the beans of this parchment is the process which must be next attended to. For this purpose it will be right to wait for dry and sunny weather, during which the coffee is spread for two or three days upon the drying platform, exposed to the rays of the sun. Even on the day when the pounding is to be performed, it is necessary that this exposure should previously take place, that the beans may be well warmed by the sun-beams: — they cannot be too dry.

Various methods have been adopted for pounding coffee, in order to remove the parchment. The most usual plan is to provide a solid wheel, made of hard wood, six or eight feet in diameter, and from eight to twelve inches thick. This wheel is made to work in a circular trough by means of an axis passing through its centre, one end of which is connected by an iron collar with the centre post of the mill, while the other

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end projects over the mill course, and a horse or mule being harnessed to this end, the wheel is carried round the trough.

When the pounding-mill is set to work, the coffee is thrown into the trough, and the parchment having been already loosened from the beans, and rendered very friable by the repeated dryings it has undergone, is easily broken by the wheel and separated from the beans.

Upon some inconsiderable properties, large wooden mortars are employed for removing the parchment. Two negroes are placed at each of these mortars, and with wooden pestles give alternately blows to the coffee, which is thus easily freed from its pellicle. It requires the labour of fourteen stout negroes thus employed, to operate upon twenty hundred weight of coffee in a day.

Entirely to remove all the small particles of parchment which may still adhere, the coffee is next conveyed to a winnowing or fanning mill. It is best to do this at the moment when it is taken from the pounding-mill or mortar. For this further operation, a mill, consisting of four vanes, formed of ten plates, and fixed upon an axis, is set in forcible agitation; for which purpose, the strength of a negro is quite sufficient. The air put into violent motion by means of these vanes, frees the coffee from every particle of the parchment which may still adhere to it, as well as from all the dust which it may have attracted. This completed, it must be again exposed during some hours to the sun's rays, and then carried to a well smoothed table made of hard wood, round which, negroes are placed, who pick the coffee carefully, berry by berry, removing every foreign substance, together with all broken and unsightly grains from those which are perfect.

In conducting this process, a large heap of coffee is placed in the middle of the table, whence each picker supplies himself, from time to time, with a lesser heap, from which again a handful is separated and spread about thinly near the edge of the table, so that every faulty grain may be easily detected on inspection. These being all removed, the remainder is swept by the hand into a bag, with which each picker is provided, the quantity of its contents being the measure of the industry

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that has been used by each. When the coffee is good in quality, the garbling process goes forward very rapidly, and a diligent picker should in such case examine and separate, at least, a hundred weight of merchantable coffee in a day.

The broken coffee, or Triage, being of less value in the market than that which is sound, it is packed and shipped separately: the difference between the two descriptions, has more reference, however, to their appearance, than to their real qualities.

Towards the close of the crop, the quantity of berries brought to the works is so small that it will hardly repay the expense of collecting. It is necessary, however, to gather the whole, and thus put a stop to the exhaustion of the trees. When gathering in this last portion of the fruit, the labourers may likewise, employ themselves in removing the suckers from about the roots of the trees; and this work may be performed with greater advantage to the trees, and with far less labour than would be required after the suckers have attained to greater size and strength.

The last gathering will include many berries that are still green, or only partially ripened. Some planters sort these, and subject those among them which are ripe to the various processes already described, while they simply dry the unripe portion in the husk, and after keeping it for some time in store, clean and prepare it in small quantities, as it may be wanted for the use of the plantation.

As soon as it has been winnowed and picked, the coffee should be packed; if this be not done, and it be left exposed, it will speedily lose colour, which being made one of the tests of its quality, will cause it to sell for a lower price in the European markets. The packages in which it is conveyed, are either hogsheads and smaller casks, or bags which will contain about one hundred and fifty pounds each: casks are commonly used in English colonies, while bags are almost universally employed by foreign planters. In some of the Eastern countries of production, coffee is packed in bales. The advantage of using casks is, that the coffee is less exposed in them to receive damage than when packed in bags, the merits of which consist in their greater cheapness, and in the smaller space which they occupy in the vessel's hold.

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It has been proposed as an improvement upon the present practice, to ship the fruit of the coffee tree entire as it is gathered, first drying the cherries to prevent their fermenting. The grounds assigned for this recommendation are, that the removal of the husk and parchment, would probably be effected with less injury to the beans by means of machinery in this country, and that the coffee would be better protected from damage on the voyage to Europe than it is at present. It does not, however, appear probable that any advantage of these kinds would be derived from the plan which would outweigh the heavier rate of freight, that would certainly be demanded on the bulkier article. In every case where a choice is presented, it is certainly adviseable to put coffee on board ships in which no other kind of produce is conveyed, and this choice is very commonly offered in colonies where the cultivation of coffee is followed to any considerable extent. If shipped in company with sugar, it is highly adviseable to pack coffee in good casks, rather than in bags, to preserve it from taint.

It may not be useless or uninteresting to add to the foregoing description of the coffee tree, and of the mode of preparing its fruit for sale, some short notice of the qualities of the berry as an article of food, and of the means whereby those qualities can be developed in the highest degree. Information upon these points is calculated to further one principal object of this work, by adding to the consumption, and consequently, by encouraging the cultivation, of a very important article of colonial production.

It is well known that the effect which follows the partaking of a strong and well prepared decoction of coffee, is exhilaration of the spirits accompanied by temporary watchfulness, but followed after a time by profound and refreshing sleep. That these effects do not always ensue upon the drinking of this beverage, may generally be attributed to the imperfect manner of its preparation.

From some experiments made by Professor Donovan, and

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which were detailed by him in the Dublin Philosophical Journal for May 1826, it appears that the narcotic property of coffee does not belong to it in its natural state, but is developed by the roasting process to which it is subjected. Mr. Donovan found that the exhilarating quality was only manifested, when that process had been carried far enough to invest the berries with a sensible degree of bitterness. It therefore becomes a question of some interest, how the roasting can be best performed with a view to the securing of this advantage, and at the same time to the production in perfection of that aromatic flavour which is so grateful to the palate. Mr. Donovan has described the appearances put on by coffee in its different stages while roasting, and as a knowledge of these appearances will assist us in understanding the principle upon which that process should be conducted, the passage is here inserted.

"When a quantity of coffee is first put over the fire to roast, a steam issues from it which is merely water, nearly tasteless, and of an ill smell. After some time, the water, which continues to be discharged, becomes acid to the taste, because that impure vinegar called pyroligneous acid is formed in it; and in some further time, the acid water is discharged of a yellow colour. Meanwhile the coffee has assumed a fragrant odour, a light brown colour, and a bitterish taste. Shortly after, the water comes off brown, with some drops of a brownish oil of a burnt smell, and the coffee appears blackish. If the roasting be conducted in a proper apparatus we can collect the products; and then we obtain a large quantity of brown liquid of an acid subastringent taste, like pyroligneous acid, and a brown, strong-tasted oil of a tarry smell, becoming when cold, as solid as soft butter. During the process of roasting, and in the beginning, while the water evaporates off, the coffee appears scarcely changed, but when the water becomes acidulous, the coffee is of a fawn colour; and when the water comes over yellow, the coffee is brown, crackles, bursts, swells to nearly twice its original bulk, and has an aromatic smell and warm bitterish taste. When the oil makes its appearance, the coffee is almost black, its taste is exceedingly bitter, and it has a burnt smell. If the heat be still continued, the coffee is con-

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verted into mere charcoal. Thus there are five distinct stages: first, the evaporation of the mere water; second, the formation of the colourless acid water; third, the production of yellow acid water; fourth, the appearance of the oil; and fifth, the conversion of the coffee into charcoal, and destruction of its bitter principle."

The third stage which is here described appears to be the most important, if flavour alone is to be considered; but the degree of roasting which produces the most desirable taste, is not that which invests the coffee with its greatest exhilarating quality, to produce which the roasting must be continued to the fourth stage. "To make coffee, therefore, that combines, as much as the nature of the thing permits, all the advantages in question, it must not be roasted either to the third or the fourth stage, but to the precise limit between the two, for then the aromatic bitter is not burnt out, but the exhilarating principle is developed to a considerable extent, although not perfectly."

To effect this precise purpose, it is recommended to continue the heat in roasting coffee, until the chief part of its water is dissipated, and it begins to grow brown. It is obvious, that when the outside of the berries has put on this appearance, the inside having been less acted upon by the heat, will be too little roasted, and this portion, when ground for use, will be too raw to produce even the desirable degree of flavour, while the exhilarating property will be scarcely at all developed. The lover of coffee will require no apology for the insertion of those passages of Mr. Donovan's paper, which point out the means of combining both these advantages in the greatest degree.

"Instead of roasting the coffee in an atmosphere of its own steam, (which effect will be produced if a close vessel is employed), it will be better to dry it on a large iron pan over a very gentle fire, keeping it constantly stirring, so as to present new surfaces, until the colour become yellow. In this way, the chief part of the water will be dissipated without exerting any detrimental influence on the substance which is afterwards to form the aromatic bitter. After being thus dried, the coffee should be pounded into coarse fragments, by no means too fine, each kernel as it occurs, being divided, perhaps,

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into four or five parts. In this state it is to be transferred into the roasting apparatus, and scorched to the proper degree.

"What the proper degree is should be now considered. The retailers almost invariably roast their coffee too little: the more it is roasted, the greater is the loss of weight on it, and the less their profit is at a given price. I have made a great number of trials to ascertain this point, and I believe that the following conclusions will be found very near the truth. The loss of weight seems to afford the best criterion.

"The mere loss of weight will not certainly direct us, for if two equal portions of raw coffee be roasted to the same and proper quantity of loss, one by a quick strong heat, the other by a moderate heat, it will be found that the liquid coffee prepared from each of these, with equal measures of water, will be of very different flavours; that done by the strong heat, being vapid and too bitter; and the one obtained by a moderate heat, being aromatic and full on the palate. The process should therefore in every case be conducted by a gentle heat; and in the following estimates, it is to be understood that such heats were employed.

"If sixteen ounces (avoirdupois) of raw coffee be roasted until reduced to fourteen, the powder obtained will be brownish with a tinge of orange: the taste of the liquid coffee prepared from it will be poor and raw, and it will want the enlivening quality for which it is valued. Yet this is pretty much the rate at which the retailers roast it, and the vapidness and poverty of our coffee are invariably remarked by foreigners. My trials have convinced me, that the rate at which we combine the greatest number of advantages in roasting, is to reduce fifteen ounces of raw coffee as obtained from the merchant, to twelve, by a very gentle heat. Any thing more than this, makes it too bitter: any thing less, does not develope all the perfections of which the process is susceptible. Thus, one-fifth of the weight of the raw coffee should be roasted away; the residue, when ground, or even while whole, will be of a bright chocolate colour, and the liquid coffee prepared from it, will be a bright brown with a tinge of orange. In cases where weighing cannot be effected, the next best criterion, although

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a bad one, will be the bright chocolate colour. The instrument in which the roasting of the coffee should be performed, after it has been dried on the iron pan, should be as close as is consistent with the necessary escape of vapours, for in this way the dissipation of the aroma is in a great measure prevented. The glass oil-flask used throughout Italy answers extremely well, and is by no means so liable to accidents as might be supposed. It will roast somewhat less than a quarter of a pound at a time, but it is best to roast only as much as is wanted at once, as it is always injured by keeping even for a short time, in consequence of the hygrometric water which it absorbs.

"The material of which the roaster is made, should be of such a nature as will not transmit the heat speedily from the fire to the coffee; or, in other words, it must be a bad conductor of heat. If it be a good conductor, coffee will be permeated by the heat too quickly, and the benefits of a slow fire will be rendered less availing. It is partly on this account, that the glass oil-flask succeeds so well, and that the common sheet-iron roaster succeeds so badly. Earthenware would answer as well as glass; but as this is not easily procurable, we may derive the same advantages by other means. If a roaster be constructed of a sheet iron cylinder, contained within a wider cylinder, so that there shall be half-an-inch space between them on every side, we have the advantage of compelling the heat to pass from the outer to the inner cylinder through a stratum of air, which is one of the worst conductors of heat in nature. If this compound cylinder be hung upon an axis, in a frame with a close cover, and a winch to turn it horizontally over the fire, we are provided with a roaster, comprising all the advantages of glass, with the durability of metal. The containing vessel should never be filled more than one-third, for by roasting, the bulk of the coffee is nearly doubled; and there must then remain sufficient space to permit the free agitation of the grains, so as to bring all parts in contact with the source of heat."

It is next to be considered, how all the good qualities thus developed in the roasting, can be best extracted by means of water. Various methods are employed to this end. Some

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persons are content to make a simple infusion by pouring boiling water on the ground coffee; some boil it for only a few minutes, and other persons allow it to continue boiling for some time. That the first plan is not effectual to extract all the virtue appears from this, that if, after having been infused in boiling water for half-an-hour, the grounds are boiled in a fresh portion of water, this will acquire both colour and flavour, together with *a great degree of bitterness.* The exhilarating quality is therefore not given out to the water of infusion, and, although this extracts the greatest portion of the aroma and peculiar flavour from the coffee, which would have served to cover the bitterness, it is clear that this method does not realise all the advantages that might be experienced. If, on the other hand, the boiling process be adopted and continued for a long period, the bitter taste and exhilarating quality will remain, but all the grateful odour and taste will be dissipated — this plan is evidently therefore to be avoided.

The mode of proceeding which, after many experiments, Mr. Donovan found to be the most advantageous, he thus describes: — "The whole water to be used is to be divided into two equal parts, one of which is to be drawn on the coffee, but in an inverted order. In the usual order, boiling water is allowed to cool on coffee, but if this be inverted, cold water should be heated on coffee, over the fire, until it come to a boil, and then it is to be removed. There is no difference between this, and the usual method of infusion, as regards the retaining of the aroma, but it differs much with regard to the advantage of obtaining the liquid coffee at the end of the process, boiling hot instead of cold, and thus making a re-heating necessary, which is always injurious. As soon as the liquor comes to a boil, it should be allowed to subside a few seconds, and must then be poured off as clear as it will run. The remaining half of the water, at a boiling heat, is immediately to be poured on the grounds; the vessel is to be placed on the fire, and kept boiling for about three minutes. This will extract all the bitterness left in the grounds, and after a few moments' subsidence, the clear part is to be poured off and mixed with the former liquor. This mixed liquor now contains in per-

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fection all the qualities which originally existed in the roasted coffee, and it is as hot as any taste can desire it. The boiling here recommended with the second half of the water, cannot be detrimental to the aromatic and volatile portions of the coffee, which have been already removed and secured in the infused portion."

It is necessary to grind the roasted coffee to a very fine powder; a point which is not sufficiently well attended to in general. It is besides evident that no care or skill in the various processes will lead to a satisfactory result except the raw coffee is of good quality. Nor will it be possible to produce a beverage that shall possess grateful and exhilarating qualities, unless a sufficient proportion of coffee be used. Less than two ounces and a half of the powder to an imperial quart of water will not yield sufficient strength to satisfy a connoisseur.

Various methods are employed in order to render the coffee, when prepared, transparent. The dried skin of a sole cut into small portions sufficiently clears the liquid, but when this is used a thin iridescent film of oil may be perceived floating upon the coffee. Isinglass requires to be boiled, in order to dissolve it sufficiently to be efficacious. The white of an egg, when used in the common manner, separates itself into a vast number of minute shreds which pass into the cups with the coffee; but, according to Mr. Donovan's experience, this substance, if previously submitted to the following preparation, will answer every purpose that can be wished in this respect.

"If the white of a number of eggs be poured out on a large flat dish, and then exposed before a brisk fire at such a distance, that they will get but a moderate heat, the water evaporates slowly from them, they diminish very much in bulk, and in the space of twelve or fourteen hours will be solid. The mass is now yellow, transparent, hard, shining, brittle, scaling off from the dish by a mere touch, which is the test of its being sufficiently done. This may be kept in a bottle for almost any length of time. A very small bit of it will answer the purpose; the weight of a silver sixpence will be sufficient to clear three ounces of coffee. All that need be done is to throw the substance into that half of the water which is to be brought to a boil on the coffee, leaving it in after that portion is

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poured off, and the remaining half of the water at a boiling heat is poured on. When the two liquids are mixed, a minute or two of rest will be sufficient to render the coffee quite transparent."

There is no reason for believing that the inferiority of West India coffee to that which is the produce of Arabia, is referrible to any peculiarities of soil or climate. On the contrary, there are good grounds for the assertion, that if equal judgment were shown in the selection of proper localities for planting, and equal care were bestowed in preparing the produce for market, West India coffee would be in all respects equal to the best importations of the Mocha bean. The soil which is most favourable to the quality of coffee is not that from which the greatest weight of produce can be derived, and until the taste of English consumers is sufficiently refined to induce them to give such an increased price for superior qualities as would make up for the smaller amount of produce, it can hardly be expected that the growers should give themselves much concern about the matter: it is their interest, in fact, now, to produce the greatest possible quantity in return for the capital and labour employed.

In the meanwhile, those persons who are desirous of having plantation coffee which shall be equal in its quality to that of Eastern production, may gratify their wish by resorting to the plan long recognised as necessary by connoisseurs who would excel in the quality of their wines. If good plantation coffee is kept during a few years in a dry situation, it will improve in a most surprising degree; time has indeed so marked an influence in this respect, that it has been confidently asserted, that the *worst* coffee produced in our plantations, if kept for ten years in its raw state, will then have as high a flavour as the very best which we now obtain from the East. When the quality is originally of a better description a much shorter time will suffice for producing an equally favourable result. If five or six years' consumption were kept in store, the end desired would in all probability be sufficiently attained, and this could not amount to any thing very considerable either in bulk or value, even to a family of most inveterate coffee drinkers.

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The Importation of Coffee into the United Kingdom during the five years ending with 1831, was as under.

	1827.	1828.	1829.	1830.	1831.
British Plantation.....	29,189,746	29,840,785	26,862,528	27,429,144	20,116,381
East India.....	5,872,511	7,380,492	6,335,647	7,066,199	7,686,500
Foreign	12,875,790	3,848,454	5,873,040	6,456,820	15,204,947
Total.....	47,938,047	41,069,731	39,071,215	40,952,163	43,007,828

Of these quantities were re-exported during the same period.

British Plantation.....	12,442,426	12,689,128	8,093,095	7,231,530	2,139,392
East India.....	4,655,104	5,084,916	7,474,169	5,187,866	6,525,417
Foreign	12,378,340	6,011,936	7,456,146	7,668,598	13,820,665
Total.....	29,475,870	23,785,980	23,023,410	20,087,994	22,485,474

The Consumption has been as follows :—

British Plantation.....	14,676,968	16,151,239	18,495,407	21,697,966	21,501,966
East India.....	888,198	973,410	975,576	989,585	1,234,721
Foreign.....	1,210	2,984	6,197	3,971	3,940
Total.....	15,566,376	17,127,633	19,476,180	22,691,522	22,740,627

The net Revenue having amounted in the respective years to

£399,690	440,245	484,975	579,363	583,751

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CACAO.

Theobroma — Cacao Sativa, or chocolate-tree. A genus belonging to the class *Polyadelphia,* and order *Pentagynia* of Linnæus; and placed by Jussieu in the family of *Malvacea.*

The cacao-tree has not been found indigenous any where except in the regions of tropical America. Its fruit was consequently unknown to the rest of the world until the close of the fifteenth century. The conquerors of Mexico found the cultivation of this tree prosecuted there to such an extent, that its produce was reckoned among the principal riches of the country, which circumstance is the more worthy of remark, because the cacao-tree formed almost the only object of regular and careful culture with the native Mexicans.

The botanical name, *Theobroma,* bestowed upon cacao by Linnæus, signifies *food for a god,* and sufficiently attests the high opinion which the great naturalist entertained of its merits. The popular names whereby we are accustomed to call the seeds in their natural state, and the preparation into which these are frequently converted, are both derived from the language of Mexico, where the former has always been known as *Cacava Quahuitl,* and the latter as *Chocolatl.*

According to Herrera, the Spanish settlers continued for some time to cultivate the cacao plantations of the native inhabitants, but were drawn off by degrees, upon the discovery

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of the silver mines, to the more enticing employment of raising the precious metal, until at length every one among them, whose labour was not essential to the production of vegetables necessary to support the lives of the rest, was engaged in mining operations.

It is deserving of remark, that while the nations of Europe have for a long series of years been principally indebted to Mexico for the means of keeping up their supply of metallic money, the seeds of a plant have from time immemorial been used as a measure of value in place of coin in many of the smaller operations of traffic in that country. Humboldt tells us that—"cacao is still made use of as an inferior coin in Mexico, and as a demi-real, which is equal to twelve sous, is the smallest coin of the (then) Spanish colonies, the common people find the employment of cacao as a circulating medium exceedingly convenient. A sous, about equal to a halfpenny English money, is represented by six seeds."

With the increase of population, agricultural pursuits were resumed, but the production of cacao gave place in a great measure to other objects, so that the Mexicans, who have retained to the present day all their liking for that fruit, now depend upon their southern neighbours for the principal part of their supply, which is consequently drawn by them in great part from Guatemala, the soil of which district is generally fertile and the cacao which it yields of excellent quality. The country just mentioned was for a long time wholly neglected by the Spaniards, because it furnished neither gold nor silver. It may be remarked, however, that notwithstanding this imagined disadvantage, the settlers in Guatemala have drawn from the surface of its soil riches of a more solid description than their Mexican customers have raised from the bowels of the earth.

The cultivation of cacao was extended by degrees not only to the Spanish provinces, south of the Isthmus of Panama, but also to many of the neighbouring West India islands. The rapid growth of these colonies at so early a period must be partly attributed to the avarice of the first Spanish settlers on the continent, who in their eager search after gold and

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silver, neglected to cultivate for the markets of Europe productions which would have been favourably received there. Adventurers from other countries were tempted by this conduct to appropriate to this purpose the smaller insular spots which continued open to them, and consequently, from comparative nooks and corners of land, Europe was supplied with tropical productions in greater abundance than were yielded by the vast dominions of Venezuela and Mexico. Of late years the cultivation of cacao in the islands, has for the most part given place to the production of sugar, which for a long time proved a source of much greater profit to the planters.

The only English islands in which cacao is at present cultivated to any extent are Trinidad, Grenada, and Saint Lucia. The high duties which for a long time were levied upon its consumption in the mother country, doubtless contributed to circumscribe its cultivation, by restricting the use of chocolate to the more wealthy classes. These duties have now, however, been almost wholly removed, and it is fair to presume, that an article of food, which is acknowledged to be highly nutritious, and which enjoys a great degree of favour with the inhabitants of other countries, will gradually become better appreciated by the British public, so that a considerable extension of its cultivation will be necessary in order to supply the demand of our markets.

If this expectation should be realized, it will be a fortunate circumstance for some of the least wealthy proprietors in our West India colonies, since the cultivation of cacao calls for only a comparatively small establishment of labourers, and does not demand any extensive outlay of capital for buildings or machinery. The principal disadvantage attending this pursuit arises from the length of time that must elapse after the planting of the trees, before any produce can be looked for. An active and intelligent planter will, however, find ways for profitably filling up this interval, during which cacao trees require but little care.

According to Humboldt, cacao plantations in Mexico are principally settled by persons in a humble condition, who thus " prepare for themselves and their children, a slow but certain

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fortune. A single slave is sufficient to aid them in their labours. They clear the soil with their own hands, raise the young cacao plants beneath the shade of the erythrina or of the banana, prune the trees, destroy the swarms of worms and insects that attack the bark, the leaves and the flowers, dig trenches, and submit to lead a life of privation for the space of seven or eight years, until the cacao trees begin to bear fruit. Thirty thousand trees assure competence to a family for a generation and a half."

The privations to which the philosophic traveller has here alluded, are perhaps inseparable from this pursuit under circumstances similar to those in which the Mexican cacao planter is placed, his labours being generally undertaken in spots remote from any market that will take off such harvests as he might raise with but little additional labour between the time of planting his trees and the gathering of their fruits. This want could scarcely ever be felt in the West Indies, nor is it probable that any one would there set about the formation of a plantation, whose means were so scanty and inadequate as Humboldt has described.

In forming a cacao plantation, it is absolutely necessary to choose a productive soil. Where new land is to be selected for the purpose, that should be preferred, whereon trees whose roots strike deep into the earth, are already growing in such a state of luxuriance as attests its fecundity. It is better to avoid a situation that is exposed to the north; if possible, a situation should be chosen on the bank of a river, or at least so near to water, that the surface of the plantation can be irrigated at pleasure.

The most usual plan pursued for clearing land, is to cut down the trees already growing, and leaving them as they fall until they are sufficiently dry, to burn them. Means are then taken by cutting trenches at proper intervals, to drain the land of all superabundant moisture.

Seedling plants must be raised in nursery grounds, which must occupy dry and sheltered spots, and the soil of which they are composed should be rich and well worked. The method of sowing the seeds is to raise small mounds in rows

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at regular intervals, and in each of these mounds two seeds are deposited and covered lightly with mould. They must then be covered with plantain leaves to shelter them from the scorching heat of the sun, and if the weather has previously been dry, they should be slightly watered, but not by any means to such a degree that the water can lodge about the seeds. The season for planting must be chosen with reference to the capabilities of the spot in regard to moisture. If water should be at hand in sufficient abundance, then the dry season will be the best, as the moisture given can then be regulated to the degree that is most proper. If, on the contrary, the plantation should be at a distance from water, it will be necessary to time the sowing differently, that advantage may be taken of the periodical rains. The danger there is of these proving too violent, forms, however, a sufficient reason for the recommendation already given, to choose a site where irrigation is practicable.

If both seeds germinate, the plant which appears the least hardy of the two must be destroyed, and the remaining one must be carefully tended and kept free from weeds until it has grown to about fifteen or eighteen inches in height, which it will usually attain in about ten or twelve weeks. It is then proper no longer to delay its transplantation to the spot where it is to be permanently located. Here the plants must be arranged in straight rows in a quincunx form, with a distance between each plant of fifteen or sixteen feet should the soil be rich, and of not less than twelve or thirteen feet if it should be less fertile. Dry weather must be chosen in which to effect the transplantation, and great care must be taken to draw the plants with a clod of earth adhering to the roots, that these may not be broken or injured. In depositing them in the plantation equal care must be taken on this point, and holes for their insertion must be made sufficiently deep to prevent the tap-root from being bent. It will soon be apparent which among the plants have failed, and steps must then be taken for supplying all deficiencies thus occurring.

It is of great importance to the success of a plantation, both

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as regards the quantity and the quality of its produce, that the trees should not be planted too near to each other. This is a very common fault in our colonies, where the planters excuse the practice on the grounds — that the early meeting together of the branches screens the earth from the sun's rays, and thus hinders the growth of weeds; that in consequence, the plantation is kept in order with less labour, and that the gathering in of the crop is more easily effected through the growth of the trees being limited, — while they imagine that the greater number of trees will compensate for the diminutiveness of their size. It is reasonable, however, to believe, that it must be hurtful to the produce of a tree which, like the cacao, requires a rich soil for its proper developement, if the ground is so overplanted that it is incapable of giving a due measure of nourishment to each tree. In fact, a smaller proportional number of fruits is harvested than would be obtained if proper spaces were left, and what is at least of equal consequence, they seldom ripen so as to contain in perfection all the good qualities which they should possess.

If more attention were paid to this point and to the careful harvesting of the produce than has hitherto been bestowed by our colonists, it is highly probable that the result would prove more advantageous than they imagine. The home market for this article is likely to become of great importance in consequence of the abatement recently made in the rate of duty on importation; and as cacao produced in the British plantations is protected from interference on the part of foreign grown cacao by the retention of a discriminating duty of 37*s.* 4*d.* per hundred weight, our planters have a strong inducement given them to turn their attention to this subject, and to adopt such improvements in their mode of cultivation as there is reason to hope would be accompanied by advantage.

In the West India islands, where the growth of the trees is checked in the manner described, each tree yields on an average not more than two to three pounds of merchantable cacao, while in places where space is given for the

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CACAO TREE.—(THEOBROMA CACAO.)

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trees to acquire their full natural growth, the produce of each very commonly reaches to six and even seven pounds annually.

The motive for raising seedlings first in nursery grounds, rather than sowing the seeds at once in the plantation where the trees are intended to remain, is, that it is far less difficult in this manner to protect first the seeds and then the young sprouts from the attacks of insects, than it would be if they were distributed over so wide a space, and planted so many feet asunder as is necessary for the attainment of their full growth.

It is absolutely necessary to defend the young plants both from the scorching heat of the sun, and from the violence of tropical gales, for which purpose either plantain trees—*musa paradisiaca*—or the coral-bean tree—*erythrina*, which the Spaniards from this use of it call *madre di cacao*—must be planted between every second row. When plaintain trees are applied to this purpose, they must be cut down as soon as they begin to show symptoms of decay, lest they should fall upon and injure the young cacao trees: the coral-bean will frequently last as long as the cacao trees themselves.

During the first and second years after the trees are planted, various kinds of vegetables, such as cassava, sweet potatoes, and cucumbers may be raised with them. The distance between the rows will prevent any evil consequences from this cultivation, which, on the contrary, will be advantageous by causing the ground to be kept clean from weeds and constantly turned over, while their foliage prevents the parching of the soil.

When the tree is about two years old, it usually puts forth from five to seven branches from the top; all that appear beyond the smaller number are cut away, that the others may be made to grow more vigorously: till that time only the stem is allowed to grow. In about six months more some flowers commonly appear; these must be destroyed that the growth of the tree may not be impeded by drawing off its productive powers to the perfecting of fruits at so early a stage, and it is usual to repeat this operation of removing the blossoms as they appear, until the fourth, and more com-

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monly until the fifth year. At this time the tree should be well grown and evince considerable vigour; its foliage will be sufficiently thick to intercept the rays of the sun in their passage to the ground, and no secondary cultivation can then be carried on between the rows; only the coral-bean trees can be allowed to remain, and these are still necessary as a shelter from storms.

At this time the cacao tree is of a middling height and size, growing in these respects very much like a cherry-tree of the ordinary dimensions. The bark of its trunk is of a cinnamon colour, which grows deeper as the age of the tree advances. The wood is porous and light, its branches are furnished with alternate leaves which are lanceolate and plain at the edges, smooth and glossy, eight or ten inches long, and three inches and a half broad. The flowers appear in great numbers on the principal branches and even on the trunk. A tree which is in a bearing condition presents to the eye at the same moment, buds and full blown flowers and fruits in different stages of their progress towards maturity. The buds resemble cherry stones in size and form, and are white with a tinge of green or pink. The flowers are small without smell, and grow in bunches; they are sometimes of a saffron colour, and at other times of a pink or flesh colour. A great number of these flowers fall without fructifying, so that the fruits are not very numerous. Some of them are seen growing on the trunk of the tree and others from the lower sides of the large branches; it is seldom that more than one in each bunch of flowers comes to maturity although more may occasionally form their fruit. The shape of this somewhat resembles that of a cucumber, but is much thicker. The colour while growing is green, but as it ripens, changes to a bluish red approaching to purple with pink veins. In some varieties the fruit becomes of a delicate yellow or lemon colour. The surface appears roughened in a manner similar to some kinds of melons, and is deeply furrowed through the entire length of the fruit by lines which divide it into eight or ten compartments. When over-ripe the pods will sometimes open, so that the seeds are permitted to drop. The external covering of the seeds is so hard as to require some

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CACAO FRUIT.—(THEOBROMA CACAO.)

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force to break it; when it is opened, the interior is seen to be composed of five compartments, inclosing from twenty to thirty seeds which are arranged in symmetrical order—these seeds are the cacao of commerce. The substance by which these seeds are surrounded is a melting and somewhat gelatinous pulp, the agreeable acidity of which renders it exceedingly refreshing in a hot climate: it has usually a little sugar mixed with it when eaten. Humboldt tells us, that the savage tribes of the Orinoco suck this pulp of the fruit and spit out the seeds, heaps of which are frequently found where those people have encamped.

The young trees must be occasionally pruned; but if this operation is too frequently performed, it will weaken them. Suckers should be removed as they appear, that the full benefit of all its circulating fluids may be given to the productive portion of the plant. The walks between the trees must always be kept free from weeds; and the trenches, formerly mentioned, maintained in a state that will prevent any water from stagnating around the roots. These strike at length to the depth of five or six feet, and during the growth of the trees, the trenches must be continually deepened accordingly. All cryptogamous plants must also be removed from the trees, and a continual watch must be kept for insects and reptiles in order to their being destroyed.

Many of the injuries to which cacao trees are liable, arise from the attacks of insects. The most destructive of these, is a small caterpillar of an ashy-grey colour, and furnished with two horns, the points of which are directed upwards. These caterpillars conceal themselves in holes, which they make in the bark of the tree; they must be picked out and destroyed by hand. On being squeezed they emit a hissing sound, resembling that which accompanies the falling of water upon heated iron, and they are so tenacious of life, that they exhibit active signs of vitality for some time after the head has been separated from the body. Another very destructive in-

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sect frequently makes its appearance at the commencement of the rainy season. This likewise takes the caterpillar form, is commonly about four inches long, as thick as a man's finger, and of various colours. These animals are so numerous in some seasons, that if allowed, they would quickly strip the trees of every appearance of foliage, and it is necessary to employ all hands for their extirpation. To complete this object effectually, as soon as the insects have put on the butterfly form, large fires should be kindled in different parts of the plantation, to which they will immediately fly, and may be readily destroyed.

Another description of insect, called by Spanish planters, *rosquilla,* flourishes in dry seasons, and must be attacked by equally vigorous measures. Others, which they call *acerredores,* resemble in form the worms first described, but are larger and black; these destroy the bark, and gnaw the wood of the trees, while the leaves and flowers form the objects of attack to the descriptions before-mentioned.

Some of these pests form their nests in the earth, and when discovered, may be effectually destroyed by pouring water into their nests, and stirring them together until the whole is reduced to a semi-fluid state.

All parasitic plants must be carefully removed as soon as they appear upon the trees, otherwise these will very quickly perish. A few hours in each week, devoted to this task, will generally suffice for its due accomplishment; but it is a work which cannot be neglected with impunity.

Cacao trees are likewise subject to a disease, which shows itself in the form of black spots, or blotches, on the bark, and which, as soon as they appear, should be carefully cut out, or the trees will quickly die. This disease does not make its appearance until the trees are in a bearing state.

There are many situations in which, although the planter should be fortunate enough to escape the evils here enumerated, or has been able to overcome them by attention, he is still liable to have his crop diminished in a serious degree by other depredators. Birds, of the parrot tribe, as well as monkeys, are great devourers of the pulpy portion of the

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fruit, and frequently destroy even much more than they consume.

When cacao trees have once attained their full growth and come into productive bearing, there are but few objects of cultivation which call for fewer cares or less labour, in proportion to the extent of the produce obtained. A French writer, alluding to this subject, says, characteristically enough, "The planter may thenceforth enjoy in peace the possession which he has created. The trunks, deprived of their leaves to the height of eight or ten feet, allow the eye to wander in all directions through the plantation. Interminable vistas present delightful points of perspective, and prepare for their rich possessor, a temperature always refreshing. It is difficult," adds this lively writer, "to imagine any man happier than a cacao planter, when his estate has arrived at this condition. He has nothing more to do than to walk through his property, casting about him the eye of a master, examining into the healthiness of his trees, and remarking if water has been applied to them in the proper degree."

Although the cacao crop may be said to last through the whole year, there are yet two principal gatherings of the fruit; one in June, and the other towards the end of December. On the continent of Spanish America, the planters are accustomed to gather their crop while the moon is on the wane, because, say they, experience shows us that the cacao is then more firm in its texture, and is not so liable to become worm-eaten, as when gathered at another season. It is probable that this opinion is mainly founded on prejudice, and it is certain that it cannot be acted upon without risking the loss of some of the ripened produce.

It is absolutely necessary that unripe pods should not be picked and mixed with those which have reached a state of maturity. The addition of a comparatively small number of green seeds will injure the quality of a whole crop. In their unripe state, the seeds of cacao have a sharp, bitter, and highly disagreeable flavour, which no drying will remove. If, through the carelessness of the gatherer, or by accident, a few unripe pods are collected, they should be left, during

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some days, exposed to the sun, and these seeds should on no account be mixed with the rest. In order to avoid this evil, none but the most careful and experienced negroes should be entrusted with the task of gathering the fruit; to such, it will never be difficult to select those which are ripe; their red, or deep yellow colour being a sufficient guide. The only spot of green upon the pod at this period, is immediately at the extremity farthest from the footstalk. The negro employed in gathering the fruit, is provided with a long wooden rod, forked at one end, and proceeding with this slowly and regularly between the rows, selects the ripe pods on the trees at either side, and readily disengages them with the forked part of his rod. He is followed by another negro, whose duty it is to collect the falling pods into small heaps, that they may be the more readily taken to the shed in which they are to be deposited, preparatory to their seeds being extracted. Women, and the weakly and infirm negroes on the plantation, are employed for separating the seeds. The place chosen for this operation must be swept very clean. Some of the party cut open the pods with a knife, or break them with a small mallet, while others separate the seeds from the pulp by means of a wooden spatula.

In fine weather, this process may be performed even at the foot of the trees, so that only the seeds are conveyed to the shed, while the pods are left to manure the soil.

As they quit the pods, the seeds are surrounded by a considerable portion of the pulp in which they were hidden, to remove which, they are thrown into holes made for the purpose, and covered over with fine sand. In this state they are left until a slight fermentation comes on. To prevent this fermentation from reaching an injurious effect, the cacao must be often stirred, and a fresh layer of sand must each time be poured over it, by which means, the moisture which is developed will be absorbed. The superintendance of this delicate operation should be committed to an intelligent overseer, if the proprietor himself cannot undertake the task; for if the fermentation should become too violent, the loss of the crop, or at least a great deterioration of its quality would ensue.

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Thus treated, the cacao, at the end of three or four days, will have lost all, or nearly all, of its moisture; and nothing further is required, but to spread it out in the sun upon a platform purposely prepared, or simply upon rush mats, but care must at the same time be taken to preserve it from the effects of rain. For this purpose, large sheds should be at hand, in which the air has a free circulation, and into these the cacao should be carried on the approach of showers. This exposure to the sun must be persisted in until the seeds are perfectly dry, an effect which is known to be attained when the cacao, on being heaped together, shows no sign of fermenting, and when the seeds split if squeezed in the hand. It may then be put into bags, or laid up in large wooden boxes, raised at least two feet above the surface of the ground. The packages into which it is put must not be too perfectly closed, since the presence of air is always needful to prevent damage. Before cacao is packed, a careful planter will use the precaution of separating all faulty seeds from such as are perfect.

It will not answer for the planter to retain his produce long in his possession, for in spite of every precaution that can be taken to prevent it, in a tropical climate, cacao will soon be attacked by moths, who prove its most destructive enemies.

Soconusco, Maracaibo, and Magdalena, are generally reckoned to produce cacao of the best quality. The seeds of that which comes from the first-mentioned of these places are variously shaped, being sometimes nearly an inch long, and somewhat narrow, while at other times they are short and broad: they are always well matured and plump. The husk is of a greyish colour and smooth texture, and it does not adhere strongly to the kernel, which is always of a bright brown colour and breaks readily. When the seeds are bruised, the paste is also of a bright brown, and it smells agreeably, but not with a strong aromatic flavour. This description of cacao is usually packed for shipment in serons, made of buffalo hides, each containing about one hundred weight, and there is little fear of the manufacturer encountering any dust or other foreign matter mixed with the seeds.

The cacao of Maracaibo and Magdalena differ from the

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preceding in the shape of the seeds, which are shorter and wider; they are besides not equally well matured. The husk is sometimes of a clay colour, and at other times of a lively red; the kernels are reddish, and the paste, when they are crushed, is of an agreeable red colour. Shipments are generally made from these places in serons, which contain one hundred weight each, and which are made either of skins or of cloth; these kinds of cacao, equally with that of Soconusco, are free from dust and other foreign substances.

Caraccas and Trinidad cacao rank next in quality to those above described. In choosing that of the Caraccas, such only should be selected as appears perfectly well matured and fully grown. The husk should be rather thick, and exhibit on its surface an appearance of micaceous earth. The kernel should be always of a clear brown colour, and when the seeds are crushed, an odour, slightly resembling that of musk, should be perceptible. Chocolate made from this cacao is of a good colour, and its delicate aromatic flavour is easily distinguishable by connoisseurs. This kind is usually shipped in bags, likewise containing about one hundred weight. It is to be regretted that the planters do not attend sufficiently to the necessity of separating from their produce the small particles of husk, as well as the dust which it has acquired.

Trinidad cacao very much resembles that of the Caraccas, but the seeds are generally less plump. The husk is covered with a greyish kind of earthy matter, unmixed with any shining micaceous particles, and the kernels are of a blackish tint. The seeds are more flat than any that have been yet described, and they are not equally well-matured. This produce comes to market in bags of about an hundred weight and a half each, and the seeds, like those of the Caraccas, are for the most part accompanied by a considerable portion of dust, and other foreign bodies.

Cacao, produced in Guiana, does not bear a reputation equal to that of the kinds already described. The forms in which the seeds appear are very various; the husk is soiled with an earthy substance of a grey or yellow hue, and the kernels are of a dark brown. The flavour of this cacao is somewhat bit-

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ter, and its aromatic quality is not great. On the other hand, the planters are careful to separate from it all substances that would lessen its value in the market.

The cacao of Brazil is long and somewhat flattened in shape, rounded near the end where the germ is placed, and pointed at the other end. The husk is either grey, or of a dingy red; the kernels, when ripe, are of a bright brown colour, and their flavour is agreeable, but when not perfectly matured, the flavour is harsh. Care is taken to free this cacao from all other substances, when it is packed for shipment.

It is hardly possible to assign any distinguishing characteristics with regard to cacao grown in our other West India colonies. The seeds are of all forms, colours, and sizes; a circumstance which shows that but little pains are bestowed upon either the selection, or the cultivation of the plants; and we are left to indulge the hope, that a more favourable result would be experienced than now attends the cultivation of cacao in those colonies, if pains were taken to select only the best specimens, and to cultivate them carefully.

The word Chocolate, which we have borrowed from the language of Mexico, to denote that preparation of cacao which is most in use among Europeans, was applied by the Indians to an article different from the one now found upon our breakfast tables. The chocolate of the Mexican was a mixture of boiled maize and cacao, roughly bruised together, between two stones, and boiled with water; a large portion of cayenne pepper being used to season it: for this last-mentioned ingredient, honey was sometimes substituted. When the produce of the sugar cane found its way to Mexico, it was soon employed to correct the bitterness of cacao, which then became so favourite and universal a drink, that it is said twelve millions of pounds of sugar were annually employed with this one article of consumption in that quarter of the world.

The improvement of mixing aromatic substances, such as vanilla, cinnamon, and pimento with chocolate, was first made in Mexico, by certain nuns, an order of persons, who, to the present day, shew much ingenuity in the preparation of delicacies. When rendered thus inviting to the palate, we are

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told that the drinking of chocolate became so constant a practise with Creole ladies, that it was served to them in the churches by their slaves, even during the performance of divine service.

It was some time before cacao found its way to Europe in any other form than that of chocolate; and when at length the unprepared seeds were imported into Spain, and the manufacture of chocolate was established in that kingdom, the Spaniards managed yet for some time longer to conceal the process from other nations, and thus to maintain their monopoly. The fondness of European Spaniards for this beverage soon became equally great with that of their Mexican colonists, and a question was seriously raised among churchmen whether or not it was lawful to drink it on fast days; some disputants maintaining that its nutritive properties were so great as to render its use objectionable on such occasions. The lovers of chocolate proved, however, too powerful for these objectors; and the point was at length gravely decided in their favour, so that they were declared at liberty to indulge their partiality without reference to the calendar.

To succeed in preparing chocolate of the best description, it is necessary to have a perfect knowledge of the various qualities of cacao. It will not suffice to know where the best is produced, and to be satisfied with selecting the growth of that place, since the quality and condition of different parcels of cacao brought from the same place vary exceedingly. Having made the selection, the first operation consists in removing every particle of dust by means of a seive, and in then separating, by hand-picking, every faulty grain and removing all foreign substances, which have become accidentally mixed with the seeds. The next process is that of drying the cacao. The apparatus for effecting this object, is so similar to that which has been described for roasting coffee, that it is needless to explain it here.

As cacao of different growths varies in the size and form of the seeds, and in the thickness of the outward husks, as well as in the degree of moisture which each kind contains, it is improper to place two sorts together in the roaster. For the

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same reason, it is impossible to state the time that will be required for attaining the requisite degree of dryness — a knowledge as to which, can only be gained by experience. When it is seen that the cacao has been sufficiently acted upon by the fire, it must be spread out upon a wicker hurdle, or some other article, which will allow a passage of air through its substance, and stirred about from time to time till it is cold; by which means, all traces of humidity will disappear. When brought to this state of dryness, it is easy to break the grains without crushing them, and after this has been done, it is equally easy to remove the husks as well as the germs of the seeds, which being hard and insoluble, cannot be allowed to enter into the composition of chocolate. By then using any kind of winnowing-mill, the small portions of husk which might otherwise escape detection, will be removed.

At this stage, the pure kernels are again to be submitted to the fire, in order to heighten their aromatic quality; but this time the torrefying process must be performed in an open vessel, and only small quantities heated at one time. The operator is guided in his judgment of the time for removing the vessel from the fire, by the odour which arises. Those chocolate makers who are most careful, pass the cacao, previous to this torrefaction, through a series of sieves, the meshes of which are at different distances, in order to avoid submitting large and small to the fire together, as in that case the whole would be unequally scorched. The taste is different in various countries, as to the point to which this scorching should be carried. In Italy cacao is burnt to blackness; in Spain the operation goes but little beyond the degree required for drying the seeds; while in this country, and in France, a middle point between these two extremes is aimed at by the manufacturer, as being most agreeable to the taste of the consumers. The object is to draw out in full perfection the aromatic flavour of the cacao, without impairing its nutritive quality, an injury which must be sustained, if the roasting be carried too far.

The step which must next be taken, is to spread the cacao upon a smooth stone, which is moderately heated, and to

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crush it with a roller, which is passed over it for that purpose with a slight degree of pressure. By this means the whole will be transformed into a kind of paste, and the rolling must be continued until this feels perfectly smooth when pressed between the finger and thumb.

In Paris, where the manufacture of chocolate is followed on a large scale, steam power is sometimes used for crushing cacao, and the process differs from that pursued in England by the addition of sugar, which is rubbed into it at this stage. The aromatic substances employed to flavour chocolate are introduced in the form of fine powder, and the whole is then worked anew, until the ingredients are made to form an uniform substance throughout. When this has been effected, the mass is sprinkled with a few drops of cold water, and it is placed in tin moulds of the required form, wherein it is left to harden while exposed to the air.

Vanilla and Cinnamon are the aromatic substances most usually employed in preparing chocolate, and the manufacturers of this country commonly confine themselves to the first-mentioned of these substances. It is remarkable, that in Mexico, which is the native region of the vanilla plant, and whence Europe is supplied with its pods, these are never used to flavour chocolate: the inhabitants having embraced the opinion that it is thereby rendered hurtful to the nerves.

In Germany the husks of cacao are removed from the kernels by immersing them in boiling water in the same way as almonds are blanched in this country. When the kernels are quite cold, they are then crushed in wooden mortars, and neither sugar nor aromatics are added until the time when it is consumed.

Cacao husks contain some nutritive mucilaginous matter, as well as a little flavour, and they form a considerable article of commerce for the consumption of poor people in Switzerland and Belgium. These husks are likewise brought into the United Kingdom, and their cheapness causes them to be consumed in Ireland, where the drink prepared from them has acquired the opprobrious, but scarcely inappropriate, name of "miserable."

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The importations of Cacao into the United Kingdom during the five years ending with 1831, were as under.

	1827.	1828.	1829.	1830.	1831.
British Plantation	549,511	459,718	683,098	742,249	1,491,947
East India	....	....	....	828	....
Foreign	4,066,221	1,177,282	2,526,835	1,322,339	1,991,171
Total	4,615,732	1,637,000	3,209,933	2,065,416	3,483,118
Husks and Shells	463,145	340,716	237,399	348,636	282.000
Chocolate and Cacao Paste	2,345	1,957	1,782	1,685	1,316
The quantities re-exported during the same period were.					
British Plantation	516,624	43,869	82,471	29,537	36,579
Foreign	2,649,465	1,434,668	1,592,142	1,354,357	1,494,552
Total	3,166,089	1,478,537	1,674,613	1,383,894	1,531,131
Husks and Shells	....	....	....	5,057	....
Chocolate and Cacao Paste	1,032	106	211	283	37
The Quantities cleared for Home consumption were					
British Plantation	385,625	354,098	382,920	422,993	494,741
East India	....	....	....	10	....
Foreign	168	309	10,927	2,379	8,065
Total	385,793	354,407	393,847	425,382	502,806
Husks and Shells	413,998	295,996	244,139	340,088	343,781
Chocolate and Cacao Paste	1,995	1,902	1,728	1,324	1,257
The net Revenue derived from which during the respective years, amounted to					
	£13,237	11,556	11,943	13,622	15,329

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In the month of August 1832, the duty on cocoa, the produce of British plantations, was reduced from sixpence to two-pence per pound; the advantage which the cacao planters of our colonies may derive from this abatement, will be made very clearly to appear by the fact, that in ten weeks immediately succeeding the reduction, the quantity cleared for consumption in England amounted to 379,456 pounds, while the clearances from the warehouses during the corresponding period of 1831, reached only to 59,248 pounds. This increased demand occasioned, as might be expected, a considerable rise in the market value of British plantation cacao. On the 7th of August, when the low duty came first into operation, the highest price of Trinidad cacao was thirty-eight shillings per hundred weight, whereas, on the 30th of October following, the value was stated in the London price current at sixty-three shillings. This rise was evidently caused by the home demand, since Brazil cacao, the highest price of which, on the 7th of August, was twenty-seven shillings, advanced in the same period only one shilling per hundred weight.

It is further deserving of remark, that notwithstanding the repeal of two-thirds of the duty, the amount collected during the ten weeks referred to, was more than double that received during the corresponding period of the preceding year.

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VANILLA.

Epidendrum Vanilla — one of a genus belonging to the class *Gynandria*, and order *Diandria* of Linnæus, and ranking in the natural order in the family of *Orchideæ*.

At the conquest of Mexico by the Spaniards, this plant was found in use among the Aztecs, by whom it was known under the name of Tlilxochitl. The only use to which it then was and still is applied, was as a flavouring ingredient in the making of chocolate. It is rather a curious circumstance, that while Europeans, who then adopted the practice, have continued it to the present time, the inhabitants of Mexico have long ceased to employ it for their own consumption. The plant is still, indeed, cultivated by them, but only for the purpose of exportation, as they have adopted an impression, that it possesses properties which cause it to act injuriously upon the nervous system.

It is matter of surprise, that the high price always obtainable for Vanilla in Europe, should not long since have stimulated some at least among the planters in our tropical colonies, to attempt its cultivation, since it requires little or no capital or labour for its production; and it will grow almost unfailingly wherever heat, shade, and moisture are to be found, a circumstance which seems particularly to point out our settlements in Guiana as favourable to its propagation.

The great increase which may be looked for in the consumption of chocolate, in consequence of the reduction in the duty on cacao, coupled with the abatement also made in the

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duty on vanilla, form additional reasons for calling the attention of our colonists to the subject. By the same act, 2 and 3 W. 4. cap. 84, which reduced the duty on cacao from sixpence to two-pence per pound, the impost on vanilla was also lowered in an equal proportion, or from sixteen shillings and eight-pence, to five shillings per pound.

The greater part of all the vanilla which finds its way for sale to Europe, grows in Mexico, and is shipped at the port of Vera Cruz. The plant is, indeed, raised in Brazil, and its fruit is exported thence; but the quality is so far inferior to the Mexican produce, that it sells for about one third of the price obtained for the best vanilla from Vera Cruz. Small quantities of this fruit were once produced in Saint Domingo; but the present possessors of that island have long ceased to bestow any attention upon its cultivation.

Vanilla is a parasitical plant, and may be grown successfully upon uncleared land. All that it is necessary for the cultivator to do towards its success, is to dig the ground a little at the foot of a tree, and to insert therein two slips of the plant, about ten or twelve inches long; the stalk will then climb up the tree with little further care or tendance, and in the third year the plant will bear fruit. In ordinary seasons, each plant will yield from forty to fifty pods annually, and it will continue to bear thus for thirty or forty years.

The only labour attending this species of cultivation, with the exception of that required for gathering and preparing the fruit for market, is to keep the trees, around which these plants cling, free from all other parasitical plants which might otherwise check their growth. It is not even necessary that the slips should be inserted in the ground in order to their growing. It will be sufficient to this end, if they are tied to the trunk of the tree, up and around which they are intended to grow. At every joint the vanilla plant puts forth small fibres or roots, by means of which it draws its nourishment.

The leaves are ovate, oblong, and larger than those of the common laurel, but not so thick. Opposite to each of these leaves, on the lower part of the stalk, a long winding tendril is thrown out, by means of which it attaches itself to the

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VANILLA.—(VANILLA AROMATICA.)

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branches or bark of the tree. When the growth of the plant is such that it reaches the top of the tree, these tendrils are no longer of use; they decay, and the place of each is supplied by a fellow leaf. The flowers, which are large, are of a greenish yellow colour, mixed with white and stripes of red; they give out a powerful odour. These flowers are succeeded by pods growing in pairs; each of them is six or seven inches long, and about three-eighths of an inch diameter; they are green at first, then yellowish, and as they approach to maturity the colour becomes brown.

The plant comes into flower in February and March, and at this time moderate weather is desirable. If cold winds, accompanied by rain, should be experienced, the flowers will drop without being succeeded by any fruit; and on the other hand, extreme drought is equally hurtful. The harvest sometimes commences as early as March, or the beginning of April, and continues at intervals until the end of June: the fruit is not exposed to the ravages of insects. The plants yield only one crop during the year.

The cavity of the vanilla pod contains numerous small seeds, together with a black, oily, and balsamic substance, which, when recently gathered, is moist. To prepare them for shipment, the pods are carefully dried, by exposing them on cloths to the sun's rays; while warm, they are wrapped in woollen, which promotes evaporation, and at the same time absorbs the moisture. When thus treated, the pods blacken and put on a silvery lustre. On this appearing, they must be again exposed to the sun, and thoroughly dried; about eighty of the pods will then weigh a pound.

It will sometimes happen, that the weather proves wet at the time when the pods require exposure to the sun. The only plan, then, to be pursued, is to dry them by artificial heat, until the black colour and silvery spots appear. The manner in which this operation is performed by the Mexican cultivators, is to construct a frame of small reeds, which they cover with a woollen cloth, and on this they spread the pods. A fire is then made at a considerable distance below the frame, which is suspended by cords for that purpose. During the

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time that they are thus exposed to the modified heat of the fire, the frames must be gently agitated, that the drying may proceeed gradually and uniformly. This operation requires a very great degree of care and skill for its successful accomplishment; even when best performed, it will prove an unsatisfactory substitute for the more natural method of drying, the loss from damaged pods being considerably increased where artificial heat is employed. If a due degree of heat could be artificially employed, by any one of those contrivances which science has suggested for the accomplishment of similar delicate operations in this country, any increased degree of damage might probably be avoided. Apparatus for such purposes, however, is mostly expensive, and few planters will think it advisable to come under any considerable outlay of money in order to provide against only a possible evil, such a continuance of rainy weather as would render it necessary to have recourse to artificial heating, being rarely experienced within the tropics, at the season when the vanilla crop is gathered.

When the curing process has been accomplished, the pods must be carefully examined and sorted, and then packed according to their qualities. Attention to this object is the more necessary, as the accidental presence of one damaged or tainted pod has been known to spoil the entire contents of a chest on its passage to Europe.

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TEA.

The Tea-tree — *Thea* * — of the class *Polyandria*, order *Monogynia*.

The tea plant is indigenous to China, and probably also to Japan. From time immemorial the use of its leaves has been known in those countries. The consumption of tea is so immense throughout the vast country of China, among all classes who can afford to purchase the indulgence, that it has been supposed, if the European trade were given up, the price would, in consequence, be but little lowered to the native consumer.†

The Japanese ascribe to tea a miraculous origin. According to their tradition, Darma, a very religious prince, and son to an Indian king, landed at a date in their calendars answering to 510 years after the Christian era. He, with unremitting exertions, endeavoured to diffuse throughout the country a knowledge of religion and of the true God. With the hope, they say, of alluring others to virtue by his example, he pursued a life of unvaried mortification and penance. Unsheltered by any dwelling, he spent his days and nights in the exercise of prayer and devotion. After continuing this life for some years, he became worn out with fatigue, and at length closed his eyes, and fell asleep against his will. Grieved that he had thus violated his oath, he cut off his offending eyelids and threw them on the ground. Returning to the same spot on the ensuing day, he found them

* It is called by the Chinese *tcha* or *theh*. By the Japanese *tsjaa*.

† Staunton's Embassy to China.

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changed into a shrub which the earth had never before produced. He tasted the leaves, and immediately felt a renewal of strength and spirits; delighted with this discovery, he recommended so efficacious a remedy to his disciples and followers. Thenceforth the reputation of its virtues increased, and it soon came to be in general use. This saint is celebrated both in China and Japan as one by whose means so great a benefit was bestowed on mankind.* In those countries tea is considered to possess many medicinal virtues.

With the exception of this idle tale there are no traces of the first introduction of tea into China; and it is, therefore, reasonable to suppose that the plant has been known in that country from the earliest antiquity. It at the same time appears tolerably certain, that none of these leaves ever found their way into Europe among the other merchandize of the East until a very recent period; and that the Grecians and Romans, who procured so many oriental luxuries, were entirely unacquainted with that exotic leaf which is now in so general use, as to be considered almost a necessary of life in the cottage of the poor as well as in the palace of the rich.

Europeans continued in the same ignorance until little more than two centuries back. The earliest mention we find of tea is by Maffeus, in his Rerum Indicarum, published towards the end of the sixteenth century. About this time, too, it was casually noticed by travellers, who had seen or partaken of the beverage made from these leaves. In the year 1600, Texeira, a Spanish traveller, had an opportunity of seeing some dried tea leaves in Malacca, from which he was told a beverage was prepared and used by the Chinese. Olearius, in 1633, found the use of tea well known among the Persians, who obtained it from China through the Usbeck Tartars. The appearance, however, of "the black water," together with its acrid taste, did not recommend it to his notice. In 1639 a Russian ambassador was regaled with it at the court of the Mogul, and, at his departure, was pre-

* Kempfer's Amœnit. Exotic.

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sented with a quantity as a gift to the Czar; but he declined burthening himself with an article which appeared to him so little worth the transport.

The first introduction of tea into Europe is not accurately ascertained. The Dutch and English both lay claim to the honour, and both, perhaps, with an equal right. The commonly received opinion, however, awards it to the former.

Although China is now the great market whence the rest of the world is exclusively supplied with this Eastern production, it appears probable that the tea of Japan was first introduced into Europe, since the Dutch, at the period assigned, traded considerably with that country.

Tea, according to the usual account given, was introduced into England from Holland in 1666, by the Lords Arlington and Ossory, who brought home a small quantity thence, and by whose means the custom of tea-drinking in this country became fashionable. It was considered a very luxurious beverage, and a pound of tea, at that time, sold for sixty shillings. There is, however, some doubt that the introduction of tea into this country was anterior to that time. Antiquarians speak of Oliver Cromwell's tea-pot as a thing still in existence among the much prized curiosities of some connoisseurs in such matters. If there be any foundation for this fact, our incipient taste for becoming a tea-drinking nation began to be developed before the above period. Dr. Short, who wrote a curious dissertation on the nature and properties of tea, at the beginning of the last century, considers it probable that tea might have been brought into England by the first fleet which was sent to India in the year 1600; but there is no evidence to show that the use and value of this Chinese shrub were discovered on this first voyage. In a scarce tract, entitled "Treatise of warm Beer," published in 1641, the writer notices tea only by quoting the account given by Maffeus, that "they of China do, for the most part, drink the strained liquor of an herb called *Chia*, hot." From this it may be inferred that tea was not, at that period, known in England. In a very few years after, we however find that tea-drinking was not uncommon even in

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public coffee-houses. For in 1660 a duty of four-pence per gallon was levied on all liquors sold in coffee-houses, and among these the infusion of tea is enumerated. In D'Israeli's entertaining work, the "Curiosities of Literature," we find a curious document, in the form of a handbill, from Thomas Garway, the person who first sold and retailed tea in this country, and who recommended it as a cure for all disorders. This is more to the purpose than any historical account which can be given. "Tea in England has been sold in the leaf for six pounds and sometimes for ten pounds the pound weight; and in respect of its former scarceness and dearness, it has been only used as a regalia in high treatments and entertainments, and presents made thereof to princes and grandees, till the year 1657. The said Garway did purchase a quantity thereof, and first publicly sold the said tea in *leaf* or *drink*, made according to the directions of the most knowing merchants into those Eastern countries. On the knowledge of the said Garway's continued care and industry in obtaining the best tea, and making drink thereof, very many noblemen, physicians, merchants, &c. have ever since sent to him for the said leaf, and daily resort to his house to drink thereof. He sells tea from 16*s*. to 50*s*. a pound."

The first introduction of tea into Europe was met by great opposition from those whose interests or prejudices made them view the novelty as a dangerous innovation, and many pamphlets were published against the use of the pernicious leaf. Patin, a French writer, called it "l'impertinente nouveauté du siecle." Dr. Duncan, in a treatise on hot liquor, supposes that the attributing of any virtues to tea was merely to encourage its importation, while the infusion was ridiculed in Holland under the name of "hay water." On the other hand, many advocates were found in favour of this new beverage. In 1641, Tulpius, a celebrated physician and consul at Amsterdam, wrote in praise of its good qualities. It is asserted, however, that this panegyric was written by desire of the Dutch East India Company, and that it did not go unrewarded. Jouquet, a French physician, in 1667 pub-

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published a work extolling the virtues of the Chinese leaf; and, in 1678, Dr. Boutetre, another Dutch physician, asserted, in a treatise written in its favour, that the infusion, if taken to any excess, even to so great a quantity as one or two hundred cups of it daily, could not, by possibility, injure the stomach!

Of these conflicting opinions the latter soon proved victorious. This novelty speedily gained ground, and before the close of the seventeenth century, the consumption of tea became considerable, it being then generally known among the common people of England. The great superiority of this leaf, over all others, as an exhilarating infusion, may now be supposed unquestionable, since that fact can furnish the only solution to the problem, why an exotic leaf, obtained at so great a distance, and from a people, too, who merely tolerate a trading intercourse with strangers, should have come into such universal esteem and consumption. Can it be that the imagination is so acted upon by the palate as to cause the almost universal admission, that in no vegetable, other than the Chinese shrub, can similar virtues be found?

An anecdote, related of the Dutch, in their second voyage to China, would seem, indeed, to show, that for a time, even the Chinese were led to believe that a European leaf was possessed of more potent charms.

"The Dutch, in their second voyage to China," says Short, "carryed thither good store of dried sage, and exchanged it with the Chinese for tea; they had three or four pounds of the last for one pound of the first, calling it a wonderful European herb, possessed of as many virtues as the Indians could possibly ascribe to their shrub leaf. But because they exported not so large quantities of sage as they imported of tea, they bought a great deal and gave 8*d.* or 10*d.* a pound for it in China. And when they first brought it to Paris, they sold it there for about thirty livres (fifty shillings) per pound, though it was not of the best sort, for that comes from Japan and has often been sold for a hundred livres a pound, (about 8*l.* 6*s.* 8*d.*) But about thirty years ago the Chinese sold it at three pence, and never above nine-

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pence per pound, and frequently mixed it with other herbs to increase its quantity."*

The cultivation of the tea plant as an article of commerce, has hitherto been strictly confined to China and Japan, affording the only instance which can be produced, of the growth of a substance of so extensive consumption being still confined to the places of its original production. When an infusion of this leaf first began to be used in other countries, it became an object of interest to discover, whether the tree from which it was obtained was to be found more widely diffused.

Many pretended discoveries of shrubs identical with the Chinese tea-tree have been related, but on investigation these have all proved erroneous. Simon Paulli, a celebrated physician and botanist of Copenhagen, was the first who believed that he had discovered the real plant in Europe. He found on expanding the tea leaves—that they resembled so closely those of the Dutch myrtle or sweet willow (*Myrica Gale*) that he obstinately persisted they must be productions of the same species, though several eminent botanists were at the pains to expose the absurdity of his opinion.

Father Labat next asserted, in his "Nouveau Voyage aux Iles de L'Amerique," that a plant agreeing in every respect with the Oriental shrub was growing in Martinico, but from his own account this supposed tea-plant was a species of *lysimachia*, or what is called the West India tea—a shrub frequently met with in many of the West India islands. "Andrew Cleyerus," says Short, "was positive we had the tea tree in Europe till he went to Japan, when he gave up his pretensions, and tells us quite another story." Many other similar mistakes might be recorded.

The *camelia*, in the shape and appearance of its leaves has the nearest resemblance to the tea plant. In the year 1755 two specimens of the *camelia* were brought over from China under the supposition that they were the real tea plants, by M. Lagerstrom, a director of the Swedish East India Company. They were placed in the physic gardens at Upsal, and

* Short's Dissertation, p. 12.

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it was not until they appeared in blossom that the fraud which had been practised was discovered. Many attempts have been made to naturalize the tea plant in other countries, but at first the mere obtaining it as an exotic curiosity, was opposed by many obstacles, and it was only after several failures that the plant was at length successfully introduced and reared as an ornament of the green-house.

The Chinese, with a jealousy which they have always evinced, in guarding the natural productions of their country from being transplanted to other shores, make use of all possible deceptions to retain these within their own limits. Accordingly it has always been a matter of some difficulty to obtain genuine tea-seeds. Those of the *camelia* being substituted, unless the purchaser is on his guard against the practice *, and even should genuine seeds be obtained, they are liable to become rancid and spoil at sea, so that scarcely one in a thousand will produce plants at the end of the voyage. If sowed, however, in boxes filled with earth, and frequently moistened with fresh water, they would then spring up in the passage, and the young plants might arrive in safety.

Neither pains nor expense were spared to procure this evergreen from China, but though many plants of apparently vigorous growth, were from time to time shipped at Canton, out of these only one survived the voyage. This remained a long time unaccompanied by any other. At length greater success attended a better management of them during the voyage, and a few other plants reached Europe in safety. The first of these which flowered, was one in the possession of the Duke of Northumberland at Sion House. At present the shrub may be frequently found blooming in this country, but it rarely fructifies. It is, however, so far acclimatized as, when protected by matting, to stand the winter in the open air.

* The Chinese are notorious for being perfect adepts at deception. Osbeck relates, in the account of his Voyage to China, that he bought of a blind man in the street, a *camelia* which had fine double white and red flowers. But by further observing it when in his own room, he found that the flowers were taken from another; and one calyx was so neatly fixed in the other with nails of bamboo, as not to have been perceptible if the flowers had not begun to wither.

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It is considered a matter of regret by many, that Europe should be wholly dependent on China for the supply of an article of so great and universal consumption. Among others, Desfontaines has contemplated the probability, that by care and art, the tea-plant might be sufficiently naturalized in France, and be cultivated so successfully, as to furnish the country with its home supply. "It would, no doubt," says he, "be possible to propagate this valuable plant in France, if one could procure a sufficient number of individuals to make experiments, by cultivating it in different soils and under different climates. This object deserves the attention of government, as the consumption of tea is immense, and as the quantity imported every year amounts to a considerable sum, for which Europe is rendered tributary to China."* All this is, however, purely chimerical, for even if the shrub could be made to grow abundantly in Europe, the preparation of its leaves would be too expensive as respects both time and labour, to render this a profitable occupation. In Brazil, the plant has been successfully cultivated, but the price of labour is too dear to offer any hopes that tea can be prepared even in that country as an article of commerce.

Most probably this is the best solution to the apparently inexplicable problem, why the cultivation of this plant should be still confined to the comparatively narrow range in which it was grown, before the present vast demand was created for it in European markets. It is only in a country where labour is extremely cheap, that tea can be grown and prepared at a sufficiently low price, to compete with that produced in China — a country in which the great mass of the people is content to remain in the lowest grade of existence. Pigou, in his excellent account of the tea-tree, published in the Asiatic Annual Register for 1802, says: — "In one hundred Chinese, it is reckoned forty only can afford to drink tea; the others drink water only. Many, when they have boiled their rice, put water into the vessel in which the rice was boiled, to which some grains always adhere; the water loosens them and is

* Phil. Mag. 20th Vol. Annales du Museum National D'Histoire Naturelle.

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browned by the rice; that water they drink instead of tea." In Anderson's account of Macartney's embassy, there are likewise many instances given of the extreme poverty of the people, so that in the country of its production, tea is a luxury less within the reach of the lower orders than it is in England, where its price is enhanced more than six-fold by its transport so many thousand miles, and by a cent. per cent. tax levied on its importation. Speaking of the tea country, our author observes; "It is a curious circumstance, that although this province is so abundant in the produce of tea, it appears to be a very scarce commodity among the lower class of people; as the men belonging to our junk never failed, after we had finished our breakfast, to request the boon of our tea-leaves, which they drained and spread in the sun until they were dry; they then boiled them for a certain time, and poured them with the liquor in a stone jar, and this formed their ordinary beverage. When the water is nearly drawn off, they add more boiling water, and in this manner these leaves are drawn and re-boiled for several weeks. On some particular occasions, they put a few grains of fresh tea into a cup, and after having poured boiling water upon it, cover it up; when it has remained in this state for a few minutes they drink it without sugar, an article which the Chinese never mix in their tea."

A workman who gains his livelihood by plucking tea, will scarcely be able to earn more than a penny a day, which is sufficient to provide for his miserable maintenance.*

Several attempts, chiefly under the auspices of the governvernment, have been lately made at Java in the cultivation of tea, and it is supposed with every prospect of success. The following is an extract from the Report of the Agricultural Committee of Java on the progress of the undertaking.

"The new plantations formed since 1827, at Bintenzong and at Garvet, have last year far exceeded the expectations at first entertained from them. As the committee considered the Chinese decidedly the most proper persons for preparing the tea, they luckily picked up two Chinese in 1828, who

* Osbeck's Voyage to China.

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have prepared samples of the Bintenzong tea, and have been sent to Garvet to examine the quality of the plant amongst those mountainous districts; according to the samples delivered to the factory at Batavia and tried by them, and by Mr. Jacobson, the Dutch tea-taster at Canton, there can be no longer a doubt, that Java can produce tea in ample quantity; proper means and soil being adapted for the cultivation. The committee are trying every means to improve the quality and quantity, and have sent for more seed from China; for though their present plants produce abundant seeds, from the necessity of taking their samples from a number of plants, the seeds have been less available for further cultivation. Their present plantation has sprung from Japan seed, and upon comparing their produce with that of some plants received from China, they are convinced that they were originally from the same seed. There is some difference in appearance, it is true; but the chief difference they conceive in all teas arises from the manner of picking, preparing, and sorting. They have produced samples of green and black tea, and even of Souchong and Pekoe, through Mr. Jacobson's assistance."

Linnæus described green and bohea tea as being two distinct species, characterising them, the one as having nine petals, the other only six. It is now, however, tolerably well ascertained, that there is but one species of the tea plant: the varieties arising solely from soil and situation, and the difference of the quality and flavour from these circumstances, combined with the manner of culture and of preparation. This appears from the testimony of the Chinese themselves, who all agree that "there is but one sort or species of the tea tree." Chow-qua, who has been eight times in the bohea country, and who has remained there from four to six months each time, says "that many people among their tea-leaves, especially at Ankoy near Amvy, put leaves of other trees; but of these there are but two or three trees, the leaves of which will serve that purpose; and they may easily be known, especially when opened by hot water, because they are not indented as tea leaves are."

He says, "that bohea may be cured as hyson, and hyson as

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TEA—(THEA VIRIDIS.)

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bohea, and so of all other sorts; but that experience has shewn the teas are cured as best suits the qualities they have from the soils where they grow; so that bohea will make bad hyson, and hyson, though very dear in the country where it grows, bad bohea. However, in the province of Tokyen, which may be called the Bohea province, some tea has for the last few years been made after the hyson manner, which has been sold at Canton as such."* Kempfer and Thunberg admit of but one species; and Sir George Staunton affirms this unity from personal observation made during his route through the centre of the tea country. From numerous observations made by Dr. Lettsom, Desfontaines, and others, it is found that the number of petals in the flowers of the same tea-plant are liable to vary from six to nine in number, and in no other respect do the flowers of different plants vary in their characteristics. Hence, the mistake of the great naturalist, who had no opportunity of judging for himself, and described this plant on Dr. Hill's authority.

The first accounts of the tea-plant were almost fabulous. Le Compte said that it grew of various sizes, from two feet to two hundred, and sometimes so thick, that two men could scarcely grasp the trunk in their arms, and Du Halde quoted a Chinese author, who described the height of different tea-trees from one to thirty feet.

A more accurate knowledge has decreased the dimensions of this tree into a shrub. It is a branchy evergreen about the height of five or six feet. The stem is ligneous, rather rigid, and inclining to an ash colour, towards the top taking a reddish hue — the branches grow alternate, but are placed in no regular order. They bear alternate elliptic leaves, emarginate or indented at the top, entire near the base, but serrated in the rest of their length, and supported on a very short semi-cylindric petiole. They are smooth and glossy, of a shining green colour, and of a firm texture. The buds grow in a husk which drops off at the period of their developement. The flowers come out singly from the axillæ of the leaves on short

* Asiatic Annual Register for 1802.

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and somewhat thick peduncles. The calyx is small and persistent, and has five obtuse divisions. The corolla for the most part consists of six petals, which are white, round, and fully expanded; the two exterior ones are smaller and unequal. The stamina are more than two hundred in number. The flowers are succeeded by capsules having three round cells united at the base, and opening longitudinally on one side only. The seeds are single, globose, angular on the inward side, and about the size of a filbert; they are covered with a thin shining pellicle of a deep red brown colour. The kernel is oily and of a bitter disagreeable flavour.

The tea-tree is confined in its cultivation to only one particular tract of country on the eastern side of China, ranging between twenty-eight and thirty-four and a half degrees of north latitude. Still farther north, the climate would be too cold, and farther south too hot, for the successful growth of this plant.

The mean temperature of the tea country, or Thekiang, is, in the month of November, 56° Fahr. at sunrise, and 62° at noon.*

The district in which the bohea tea is prepared, or, as it is called, the bohea country, is situated in the province of Tokyen, about twenty-five days' easy journey from Canton. The extent of land occupied in these plantations has been gradually enlarged to meet the increasing demand, till at length it has become nearly as much again as it formerly was. That land which produces the best bohea tea is not more than twelve miles in extent, or about twenty-five miles in circumference.† It is a very hilly country, but the hills and valleys are alike planted with this tree. The declivities of hills exposed to the south, and the vicinity of running water, are considered most favourable to its growth. The hills produce the best tea. On them grow congo, pekoe, and souchong; in the valley or flat part of the country, bohea.

The district in which the singlo tea is grown, or the Singlo

* Barrow's China.

† Pigou — Asiatic Annual Register for 1802.

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country, is about forty days' easy journey from Canton, and the Hyson country is about the same distance.

In Japan no particular gardens or fields are allotted to the planting of the tea plant; but it is cultivated round the borders of corn or rice fields without any regard to the soil. In other respects the culture of the plant is similar in both countries.

According to Pigou the ground is not manured in China for tea-plantations, nor is this shrub very tender as to soil and situation; it however thrives best and furnishes leaves of the finest quality when produced in light stony ground. The month of February is the usual time for sowing the seed, which is placed in rows four or five feet asunder: from six to twelve of the seeds are put in the same hole. The seeds contain a large proportion of oil, which is liable soon to become rancid; hence many which are put in the ground spoil, scarcely a fifth part of them germinating; it is therefore necessary by sowing abundantly to provide against this casualty. The plantation should be kept very clean and free from weeds; no other care is requisite for this cultivation.

The first crop of leaves is gathered during the third year after sowing the seed. They are then abundant and considered in their prime. At the end of seven years the shrub has attained to its full height, it yields at that time but a comparatively small quantity of new leaves, and it is then usual to cut it down nearly to its root; this produces an exuberance of new shoots which bear a plentiful crop of leaves. Sometimes this cutting down is delayed until the tenth year. In this way the roots of tea-trees last many years, sending forth, when their trunks are cut or have fallen from decay, abundance of new shoots.

The leaves are usually gathered singly; sometimes, however, whole sprigs are plucked. The quantity which can be collected in a day by one person, picking every leaf, one by one, varies of course according to the expertness and diligence of the labourer employed: it is considered an average day's work to gather from four to six pounds of leaves. Those who are most practised in the employment can often show ten and even as much as fifteen pounds, as the fruits of their one day's gathering.

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The work is continued throughout the whole of the day: before the dew has exhaled from the leaves, as well as during the heat of the afternoon's sun.

In Japan three crops are obtained during the year. The first is gathered at the end of February or beginning of March, when the young leaves are scarcely expanded. This is not a very plentiful crop, but it is held in the most esteem, and the tea, when prepared, is sold at so high a price, that its use is nearly confined to the opulent of the first rank. It is distinguished as imperial tea, flower of tea, or *bon* tea.

The second crop is collected a month later; all the leaves are then gathered promiscuously, those just expanded, and those which have arrived at their full growth; these are afterwards separated into different classes according to their degrees of age. The very young leaves are carefully selected and are often sold as imperial tea. In the month of June the last crop is gathered; this is the most abundant, but is of an inferior quality and is chiefly consumed by the lower classes of society.

When the tea-harvest of the year is closed, the last crop being gathered in, the event is celebrated by public festivals.

There is a celebrated mountain in Japan, which is devoted to the cultivation of tea for the emperor's sole use. It is situated in the vicinity of the sea, near to the small town of Udsi. This mountain has a beautiful and picturesque appearance, it is surrounded by an ornamental hedge and broad fossé, thus rendering it inaccessible to both men and animals. The plantations are laid out regularly, and arranged in a manner extremely pleasing to the eye; the shrubs are washed and cleaned every day. Those persons who are entrusted with the gathering of the leaves are obliged to bathe two or three times every day, and to wear gloves, that the leaves destined for the royal infusion may not be brought into contact with ignoble hands.

When the leaves have been torrefied and otherwise prepared, they are put into porcelain vessels of great value, and conveyed to the emperor's palace with much pomp and ceremony.

Public edifices are erected in Japan for curing tea, and

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under such regulations, that every person who has not suitable conveniences, or is wanting in the requisite skill to conduct the process, may, at any time, bring his fresh leaves here to be cured. In these buildings, there are from five to ten or twenty small furnaces, about three feet high, each having at the top a large flat iron pan which is heated to a certain degree by a small fire made in the furnace underneath. When of a proper heat—so hot that the hand cannot touch it without pain, a few pounds of newly gathered leaves are put into each pan. The fresh and juicy leaves, which crack as soon as they touch the heated vessel, are stirred as briskly as possible with the hand till the heat is too great to be endured. At this instant, they are taken off with a kind of shovel resembling a fan, and placed on tables a little raised, covered with very fine mats of straw; on these the leaves are rolled by rubbing them with the hand with a uniform and rapid motion; the slight compression to which they are subjected, presses from them a greenish yellow juice, which produces on the hands an almost insupportable heat. The operation must, however, be persisted in while the leaves are hot, and until they become cold—they will only roll to retain their curl when in a heated state. The more rapid the cooling, the better is the work performed; this cooling is sometimes accelerated by agitating the air with a kind of fan; but whatever care may be taken, there is always a certain quantity which remains unrolled, and which before the whole is finally packed, is separated from the rest. The process of torrefying and rolling is repeated two or three times, or oftener, according to the quality of the tea, before the preparation is considered completed. The Imperial tea is pulverized before being used, and, therefore, it is not necessary to roll this kind at all.* It must, however, be more torrefied than that which is rolled, that it may the better be reduced to powder of a great degree of fineness.

The various methods employed for obtaining the different kinds of tea in China, are very accurately described by Mr.

* M. Cassigni asserts that in Cochin China, it is not customary, in preparing any kinds of tea, to roll the leaves.

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Pigou. The following description is mostly taken from his account.

Bohea tea derives its name from Vov-yee, the name of the country where it grows. Should the demand for it be very great, there are sometimes four or five gatherings in the year, but this frequent collecting injures the next year's crop — the number of annual gatherings should therefore be limited to three, or at most to four. The leaves are never picked during the winter months. The first gathering, is called *tow-tchune*, and lasts from the middle of April to the end of May. The second, *eurl*, or *gee-tchune*, is begun in June and continues for a month. The third, *san-tchune*, lasts from the beginning of August to the latter end of September. Tea of the first crop commands the highest price; the second very little lower; and the third is about twenty per cent. cheaper.

The accounts given of the manner of curing the leaves differ somewhat, but not materially, from each other. According to Chowqua, the leaves as soon as gathered are put in large shallow baskets, placed on shelves exposed to a thorough air, and if not too intense at the time, to the heat of the sun. In this situation they remain from morning till noon, at which period they begin faintly to emit the fragrant odour peculiar to tea. A small quantity at a time is then thrown into a flat pan made of cast-iron, and which has been previously heated very hot, by which means the leaves are torrefied in a manner similar to that pursued in Japan. Hence, they are transferred to other flat baskets and rubbed by men's hands, till they roll or curl up. After this, they are again subjected to a less degree of heat, and in larger quantities; they are then put in baskets over a charcoal fire. This last operation is called firing; when it is completed — which must be ascertained by a person of skill and experience in the art — the tea is spread on a table, and all large, unrolled, bad, or broken leaves are carefully picked from it.

The process as described by Yungshaw, is less elaborate: the leaves as soon as gathered are sunned in baskets; then rolled with the hand; then slightly torrefied. This completes the process. Another account says: as soon as the leaves are

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gathered they are placed in sieves, or baskets, and exposed till they wither, after which they are put into a close place, excluded from the air for some hours, which is to prevent them from contracting a red hue; the smell then begins to exhale. The leaves are then slightly subjected to heat; rolled, and again heated in small quantities at a time.

Congo, or *cong-foo*, which means great or much trouble in the gathering the leaves, is according to Chow-qua, torrefied twice. Yungshaw, however, asserts, that it is not torrefied at all, but only fired two or three times. He likewise affirms, that the leaves of souchong, congo, hyson, and fine singlo, are beat with flat sticks, or bamboos, after they have been withered by the sun or air, and have acquired sufficient toughness to prevent them from breaking. This operation is performed it is said, "to force out of them a raw or harsh smell."

Pekoe, or *pe-how*, signifying *white first leaf*, is the produce of the tenderest of the trees of three years growth, gathered just after they have bloomed, when the small leaves that grow between the two first that have appeared, and which altogether form a sprig, are downy and white. Sometimes pekoe is obtained from trees four, five, or even six years old; but after that time the produce degenerates into congo if grown on the hills, and into bohea if on the plains.

Souchong, or *seow-chong*, means *small good thing*. This kind is likewise produced from the leaves of trees three years old, but only on soils particularly favourable to the culture. When older, these trees produce congo. The true souchong is very scarce. Upon a hill planted with tea-trees, one only may, perhaps, bear leaves good enough to be called souchong, and of those only the best and youngest are taken; the others make congo of the several sorts, and bohea. What is sold to Europeans as souchong, is in fact only the best congo, and the congo in its turn is counterfeited by bohea.

Lintessein is a tea made from very young leaves, which grow from the tenderest stalks—the leaves are gathered before they expand. This tea is never torrefied, but only fired. Were the leaves suffered to remain on the tree till fully developed they might make pekoe, and if still older, congo or bohea. The na-

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tives do not hold this tea in much esteem, the leaves being too young to have much flavour. It is merely cured to please the eye.

Tea distinguished as Ho-ping, is named thus from the country in which it grows, and which is about twelve days' journey from Canton. This is considered very inferior, in consequence of the nature of the soil on which it is cultivated, and which it is said imparts a bad smell to the leaves. This tea is prepared in the same manner as bohea, only the process is performed less carefully, and over wood, which is not considered so proper as charcoal, and adds still farther to its natural unpleasant odour.

Another tea, is called Looching, or Lootsia, from the name of a place situated eight days' journey from Canton. Here are produced about a thousand peculs (133,333lbs. avoirdupois) of tea in a year. This tea may be either prepared as green, or bohea, according to the demand of the market, but it is most commonly made to imitate singlo, which suits its nature best.

Houan tea grows in the country of the same name near to Canton, and is produced in only a small quantity, not more than two hundred peculs (26,666lbs.) annually. It is cured in April or May. Its use is confined to the native inhabitants of Canton. The most inferior of these leaves are only torrefied once and not rolled—they remain flat and look yellow. The better sort is torrefied, then rolled, and then torrefied again. This tea is not put over a charcoal fire—the infusion is of a reddish hue.

Ankoy tea takes its name from the country which produces it, and which is situated about twenty-four days' journey from Canton. The worst sort is not torrefied at all, but the better kinds are prepared in nearly the same manner as bohea, although not quite so carefully. Bohea tea is sometimes sent to Ankoy, to be mixed with the tea of that soil previously to the whole being forwarded to Canton. The smell of the Ankoy tea is much inferior to the tea of the Bohea country.

Singlo tea, is so called from the name of a mountain on which it is grown, situated about one hundred and fifty miles

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to the southward of Nanking. Hyson*, from *Hais-ven*, the name of an Indian merchant, who first brought it into Europe.

The manner of preparing these kinds of tea, is rather more troublesome than that of curing bohea.

As soon as the leaves are gathered, they are directly torrefied, and then very much rubbed between the hands for the purpose of rolling them, after which they are spread out to separate them from each other, for the leaves are apt to adhere together while being rolled. They are then torrefied very dry, and afterwards spread on tables to be picked, an employment usually performed by females. The leaves are then again torrefied, and afterwards tossed in flat baskets in order to clear them from dust. They are then again spread on tables and picked, torrefied for a fourth time, and laid in small heaps, which are again torrefied, and when sufficiently done are put hot into baskets, in which state they remain until required to be packed for sale. In these various torrefications, the quantity of leaves torrefied each time increases with the number of times they have been performed; at first, only half or three-quarters of a *catty*† of leaves (about half a pound) is put in, and at last ten *catties* (rather more than eight pounds and a half) are torrefied at once. The degree of heat used is likewise lessened each time. Before the tea is put up ready for exportation, it is again slightly torrefied, and then put while hot in chests, or tubs, into which it is well pressed. While the leaves are hot they do not break, an accident to which they are liable when packed cold.

Singlo being of a more brittle nature than hyson, becomes more dusty, and in the course of curing is twice tossed in baskets—hyson only once. Whenever these two kinds of tea contract any moisture they require to be re-torrefied. So that, if they be kept any time without being sold, especially in damp weather, they are always torrefied to give them a crispness before they are offered for sale.

* Pigou says it derives its name from *He Tchune*, "the name of the first crop of this tea."

† A catty is 1-150th part of a pecul, and a pecul is 133⅓lb. Avoirdupois.

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The best singlo tea, called tunkey singlo, owes its superiority to the nature of the soil on which it is grown. It is produced near to the hyson country. Singlo tea of ordinary quality, is not so carefully cured as by the process just described.

There are only two gatherings of singlo and hyson tea. The first in April and May, the second in June, and each gathering is divided into two or more sorts, according to the age of the leaf.

Hyson skin tea, as it is called in commerce, consists of the large, the flat, and the bad coloured leaves that are amongst the hyson tea. Gomi, or gobee, and Ootsien, are also leaves rejected from the hyson. The first are those leaves which are small and very much twisted, resembling little bits of wire. The Ootsien are more like little balls.

There are many varieties of singlo and hyson tea, occasioned by difference of soil and of preparation, which latter is altered according to the skill or fancy of the curer. A good or bad season likewise makes a great difference in the quality of the tea. A cold season, for instance, nips the trees and renders the leaves less succulent, a rainy season turns these to a yellow colour.

Bing tea, is so called from the man who first prepared it. It grows about four days' journey from the hyson country. The leaves of bing are long and thin, those of singlo are short and thick.

The very inferior kind of tea used by the poorer classes, is passed through boiling water before it is torrefied. Notwithstanding which, it retains a strong and bitter flavour. The leaves are also sometimes held over the steam of boiling water.

There is also another sort of tea prepared in a manner different to any of the preceding. It is made up into cakes or balls of various sizes—called by the Chinese *Pan-cul-tcha.* The largest kind of this cake tea, which has been imported, weighs about two ounces: the infusion and flavour resemble those of good bohea tea. Balls of tea are, however, prepared in China of a much larger size. Among the presents of his Imperial Majesty to Lord Macartney, were cakes of the best tea made

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up into balls, each weighing five pounds. The leaves are compressed into this shape and baked together, whereby they retain the solid form and possess the advantages of never being affected by air or climate, and of never losing their flavour though kept without any covering whatever.

Another sort is called *tio-te* — it is a kind of green tea rolled up in a spherical form, generally about the size of peas, but sometimes as large as nutmegs.

The smallest kind done in this form, is called gunpowder-tea.

From Pigou's account it appears, that the adulterations of tea do not take place only after importation, but commence in the very country of production. When tea in the Bohea country obtains a high price, the coarse old leaves are collected, and after passing them through boiling-water, are prepared like other leaves; after this, they are pounded and mixed with the finer sorts of tea, in about the proportion of five per cent.

Ankoy tea is sometimes made to resemble green, and fraudulently sold as hyson. For this purpose, the leaves of the prepared ankoy tea are spread out and continually moistened till they become a little opened. When again somewhat dry, they are put into a hot iron pan with powdered chico, and well stirred. The tea is then sifted, and if sufficiently green, the process is completed. If not, it is torrefied again, for it is the frequent torrefication which gives the green colour to the leaves.*

Ho-ping tea, which is of the bohea kind, is likewise, after being cured like bohea, altered into a green tea by the above process, and is sold for exportation as singlo.

These kinds of spurious tea are not often sold separately,

* It was formerly asserted, and believed as a fact, that green tea was torrefied on plates of copper, and to that metal owed its verdant hue. It is now however well ascertained that there is not the slightest foundation for this assertion. Kempfer, Staunton, and many other high authorities distinctly deny its truth. Dr. Lettsom made numerous experiments on tea, and never could discover the presence of a particle of copper in any under examination. The hundredth part of a grain of copper dissolved in a pint of liquid is detected by a volatile alkali, rendering the colour perceptibly blue.

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but are more commonly mixed with the genuine sort for the European market, so that the proportions in which they are mixed make combinations without end, and still further increase the number of the different qualities of tea; their intrinsic quality being dependent on soil, season, and manner of preparation.

The best singlo tea was formerly distinguished as pi-cha, which signifies the skin or covering, and which owes its name to a fraudulent practice, which has now for a long time been discontinued. In the middle of the chest a kind of well was made, which was filled with tea of the most inferior quality, while the sides and top were covered with the very best, called pi-cha, because it served as a covering to the bad.

Tea should be kept in close vessels, and completely excluded from all contact with the air. According to Kempfer, the tea brought to Europe always loses some portion of its good quality, as he uniformly found the infusion made in the country of production, more agreeable in taste and delicate in flavour.

The Japanese preserve their tea in tin vessels, which, when very large, are cased with wood to strengthen and support them—the joints of the boxes are closed inside and outside, with paper. That destined for the use of the Emperor, or his court, is put, as already mentioned, into costly vessels of porcelain.

The inferior sort of tea is least susceptible of alteration. The peasants keep this in boxes made of straw, somewhat in the shape of barrels, which they suspend under the roofs of their houses, near the holes which let out the smoke, and consider, that thus situated, the tea gets no injury.

In China, the tea is heaped up and pressed with the feet in chests made of wood and lined with sheet-lead.

Tea which is pulverized, is not drunk as an infusion in the manner we are accustomed to take it. Into a cup of boiling-water, a certain quantity of finely pulverized tea is thrown, it is then stirred with a denticulated wooden instrument, with the same circular movement as is used in milling chocolate, and while frothed up is presented to the guest.

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The poorer classes make their tea into a decoction, either boiling the leaves in a bag, or putting them in without that precaution, and straining off the liquor as wanted.

It is said that tea-leaves before torrefication have an intoxicating quality, which irritates the nerves and renders an infusion of them unwholesome. They are not, it is added, completely freed from this property, even after having been subjected to the action of fire, but require to be kept for ten or twelve months before this is entirely dissipated.* Tea then becomes a pleasant and exhilarating beverage. The Chinese consider it extremely beneficial to health, and drink the infusion entirely pure without any of the admixtures practised in Europe; merely as they sip it, holding a piece of sugar-candy in the mouth.

It is said, that this people sometimes perfume their tea with the scents of various plants. The flowers of a kind of mugwort—those of the scented olive—the *camelia usanqua*—the Arabian jasmine—the curcuma, &c.

The quantity of tea required for the consumption of so many millions of people, and the number of persons occupied in its preparation, must necessarily be very great.

The following is an estimate, taken in 1756, of the quantity of tea made in China in a year.† Its correctness may, perhaps, be doubted, since the quantity little more than equals the number of pounds prepared to meet the demand of foreign countries in the present day.

Singlo	50,000	peculs
Hyson	4,000	
Lock-ann	20,000	small baskets—not exported—bohea sort
Carried over..	74,000	

* The Chinese in consequence do not use their tea till after it has been prepared a year. The tea brought into consumption in England is still older, for besides the time taken in collecting and transporting it—the East India Company is obliged by its charter to have always a supply sufficient for one year's consumption in their London warehouses. This regulation originated from the desire of guarding in some measure against the inconveniences of fluctuating supplies in a trade entirely dependent upon the caprice of an arbitrary government.

† Asiatic Annual Register for 1802.

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Brought over .	74,000	
Moi-shan	2,000	not exported
Bing-tea	2,000	
Phow-ge tea	2,900	lumps—bohea sort
Bohea, including congo, pekoe, and souchong	120,000	to 130,000
Ankoy bohea and green sorts ..	50,000	
Ho-ping	15,000	
Ing-aan	400	bohea sort
Caw-low, made either in bohea or singlo	2,000	
Lootsien	2,000	true sort
	279,400	peculs, or 37,253,333 lbs. avoird.

The rise and progress of the consumption of tea in this country has been rapid beyond precedent. About the beginning of the eighteenth century, the Company's annual sales did not exceed 50,000 lbs.; towards its close, they approached to 20,000,000 lbs., and at the present time, they are more than 30,000,000 lbs. The annexed tables will furnish accurate data, whereby this important increase of the tea trade may be better estimated.

More than a million of people are employed in the preparation of tea for the East India Company alone. They pay to the Chinese, from 13 to 60 tales* per pecul for their tea, according to the different qualities.

The retail prices of tea in London, in 1730, were

Hyson .....36*s.* per lb
Imperial green tea .....18*s.*
Common green tea .....15*s.*
Ordinary ditto .....13*s.*
Pekoe .....15*s.*
Congo .....14*s.*
Bohea .....12*s.*

* One tale is equal to 6*s.* 8*d.*

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Quantity of Tea shipped at Canton by the East India Company, and its Prime Cost.

	lbs.	£.
1809—10	18,230,720	1,194,498
1810—11	19,710,737	1,300,321
1811—12	26,164,221	1,732,709
1812—13	28,267,413	1,972,742
1813—14	24,727,436	1,711,899
1814—15	26,195,144	1,743,081
1815—16	33,013,387	2,157,687
1816—17	29,353,973	2,017,746
1817—18	20,151,597	1,322,414
1818—19	21,085,860	1,321,696
	246,900,488	16,480,793

or 1*s.* 4·02*d.* per lb.

Quantity sold and Amount of Sales.

1810—11	23,548,468	3,896,291
1811—12	21,527,217	3,534,274
1812—13	23,068,033	3,793,383
1813—14	23,424,832	3,896,817
1814—15	27,820,643	4,794,359
1815—16	26,234,244	4,102,668
1816—17	21,029,843	3,114,479
1817—18	23,401,706	3,502,388
1818—19	26,068,870	3,987,007
1819—20	25,032,484	3,489,385
	241,156,340	38,111,051

or 3*s.* 1·928*d.* per lb.

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An Account of the Quantity of Tea exported by the East India Company from Canton; specifying the several kinds of Tea, and the average Prime Cost per lb., in the year 1829—30.

TEA EXPORTED TO ENGLAND.

	Quantity.	Average Prime Cost, per lb.
	lb	s. d.
Bohea	4,288,896	0 9·636
Congou	19,003,302	1 2·099
Campoi	556,885	1 7·382
Souchong	67,632	2 0·584
Pekoe	....	....
Twankay	4,733,704	1 3·703
Hyson Skin	101,829	1 4·411
Young Hyson	....	....
Hyson	582,800	2 3·469
	29,335,048	

TEA EXPORTED TO THE NORTH AMERICAN COLONIES.

	Quantity.	Average Prime Cost per lb.
	lb	s. d.
Bohea	329,759	0 8·857
Congou	828,944	0 10·679
Campoi	....	....
Souchong	....	....
Pekoe	....	...
Twankay	15,901	1 4·200
Hyson Skin	13,415	1 3·203
Young Hyson	....	....
Hyson	26,217	2 4·146
Gunpowder	18,828	2 6·914
	1,233,064	
Total	30,568,112	

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An Account of the Average Sale Price of Tea of each Description of the East India Company's Teas sold in each Year, from 1823.

From March 1 to March 1 in each Year.	Bohea.	Congou.	Campoi.	Souchong.	Pekoe.	Twankay.	Hyson Skin.	Hyson.	Young Hyson.
	s. *d.*	*s.* *d.*	s. *d.*	*s.* *d.*	*s.* *d.*	*s.* *d.*	*s.* *d.*	*s.* *d.*	*s.* *d.*
1824	2 $4\frac{5}{10}$	2 $7\frac{9}{10}$	3 $3\frac{5}{10}$	3 $9\frac{6}{10}$	4 $11\frac{3}{10}$	3 $5\frac{4}{10}$	3 $5\frac{2}{10}$	4 $2\frac{6}{10}$	4 $3\frac{7}{10}$
1825	2 $3\frac{2}{10}$	2 $7\frac{7}{10}$	3 $2\frac{4}{10}$	3 $8\frac{8}{10}$	....	3 $5\frac{6}{10}$	3 $6\frac{6}{10}$	4 $4\frac{3}{10}$	....
1826	1 $6\frac{9}{10}$	2 $4\frac{6}{10}$	3 $2\frac{4}{10}$	3 $7\frac{3}{10}$	3 $11\frac{9}{10}$	3 $2\frac{7}{10}$	3 $3\frac{1}{10}$	4 7	4 $0\frac{6}{10}$
1827	1 $7\frac{7}{10}$	2 $4\frac{3}{10}$	2 $8\frac{6}{10}$	3 $2\frac{9}{10}$	4 1	2 $8\frac{6}{10}$	3 1	4 $8\frac{1}{10}$	4 $2\frac{4}{10}$
1828	1 $6\frac{5}{10}$	2 4	2 10	3 $1\frac{8}{10}$	4 $1\frac{7}{10}$	2 $5\frac{9}{10}$	2 $5\frac{9}{10}$	4 $3\frac{6}{10}$	....
1829	1 $6\frac{4}{10}$	2 $3\frac{9}{10}$	2 $4\frac{9}{10}$	3 $8\frac{9}{10}$	....	2 $4\frac{1}{10}$	2 $4\frac{8}{10}$	4 $1\frac{8}{10}$	....
1830	1 $9\frac{2}{10}$	2 $3\frac{3}{10}$	2 $2\frac{1}{10}$	3 $11\frac{6}{10}$	....	2 $4\frac{1}{10}$	2 $7\frac{2}{10}$	4 2	....

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An Account of the Quantities of Tea exported from China in English and Foreign Ships in each Year, from 1776 to 1795, distinguishing each Year. Taken from Sir George Staunton's Work, Vol. ii. p. 624.

	Ships	1776	Ships	1777	Ships	1778	Ships	1779	Ships	1780	Ships	1781	Ships	1782	Ships	1783	Ships	1784	Ships	1785
		lbs.		lbs.		lbs.		lbs.		lbs.		lbs.		lbs.		lbs.		lbs.		lbs.
By Swedes ..	2	2,562,500	2	3,049,100	2	2,851,200	2	3,328,000	2	2,626,400	3	4,108,900	2	3,267,300	3	4,265,600	3	4,878,900	..	....
Danes ..	2	2,833,700	2	2,487,300	2	2,098,300	1	1,388,400	3	3,983,600	2	2,341,400	3	4,118,500	4	5,477,200	3	3,204,000	4	3,158,000
Dutch ..	5	4,923,700	4	4,856,500	4	4,695,700	4	4,553,100	4	4,687,800	4	4,957,600	..	....	..	....	..	....	4	5,334,000
French ..	3	2,521,600	5	5,719,100	7	3,657,500	4	2,102,800	..	....	..	....	..	....	..	....	8	4,231,200	4	4,960,000
Imperial ..	..	....	..	....	..	....	..	....	1	1,375,900	..	....	..	....	..	....	5	3,428,400	..	....
Hungarian ..	..	....	..	....	..	....	..	....	..	....	1	317,700	..	....	..	....	..	....	..	....
Tuscan ..	..	....	..	....	..	....	..	....	..	....	..	....	..	....	1	933,300	..	....	..	....
Portuguese ..	..	....	..	....	..	....	..	....	..	....	..	....	..	....	8	3,954,100	..	....	4	3,199,000
American ..	..	....	..	....	..	....	..	....	..	....	..	....	..	....	..	....	..	....	2	880,100
Prussian ..	..	....	..	....	..	....	..	....	..	....	..	....	..	....	..	....	2	3,329,800	..	....
Spanish ..	..	....	..	....	..	....	..	....	..	....	..	....	..	....	..	....	..	....	..	....
Total Foreign	12	12,841,500	13	16,112,000	15	13,302,700	11	11,302,300	10	12,673,700	10	11,725,600	5	7,385,800	16	14,630,200	21	19,072,300	18	17,531,100
English, Private Trade included	5	3,402,415	8	5,673,434	9	6,392,788	7	4,372,021	..	none imported	17	*11,592,819	9	6,857,731	6	4,138,295	13	9,916,760	14	10,583,628
Total	17	16,243,915	21	21,785,434	24	19,695,488	18	15,674,321	10	12,673,700	27	23,318,419	14	14,243,531	22	18,768,495	34	28,989,060	32	28,114,728

* Part of these should have arrived in 1780.

	Ships	1786	Ships	1787	Ships	1788	Ships	1789	Ships	1790	Ships	1791	Ships	1792	Ships	1793	Ships	1794	Ships	1795
		lbs.		lbs.		lbs.		lbs.		lbs.		lbs.		lbs.		lbs.		lbs.		lbs.
By Swedes ..	4	6,212,400	1	1,747,700	2	2,890,900	2	2,589,000	..	....	..	....	1	1,591,330	1	1,559,730	1	756,130	..	....
Danes ..	3	4,578,100	2	2,092,000	2	2,664,000	2	2,496,800	1	1,773,000	1	520,700	..	....	1	852,670	..	....	1	24,670
Dutch ..	4	4,458,800	5	5,943,200	5	5,794,900	4	4,179,600	5	5,106,900	3	1,328,500	2	2,051,330	3	2,938,530	2	2,417,200	4	4,096,800
French ..	1	466,600	1	382,260	3	1,728,900	1	292,100	1	294,300	2	442,100	4	784,000	2	1.540,670	..	....	..	....
Imperial..	..	....	..	....	..	....	..	....	..	....	..	....	..	....	..	....	..	....	..	....
Hungarian	..	....	..	....	..	....	..	....	..	....	..	....	..	....	..	....	..	....	..	....
Tuscan ..	..	....	..	....	..	....	..	....	..	....	..	....	..	....	1	393,870	..	....	..	....
Portuguese	..	....	..	....	..	....	..	....	..	....	..	....	..	....	..	....	..	....	..	....
American .	1	695,000	5	1,181,860	2	750,900	4	1,188,800	14	3,093,200	..	....	13	1,863,200	6	1,538,400	7	1,974,130	7	1,438,270
Prussian..	..	....	..	....	1	499,300	..	....	..	....	3	743,100	1	5070	..	....	..	....	..	....
Spanish ..	..	....	..	....	..	....	2	318,400	..	....	..	....	1	....	3	400	..	....	1	....
Genoese ..	..	....	..	....	..	....	..	....	..	....	1	260	..	....	2	578,930	2	289,470	1	17,460
Total Foreign	13	*16,410,900	14	11,347,020	15	14,328,900	15	11,064,700	21	10,267,400	10	3,034,660	12	6,294,930	19	9,403,200	12	5,436,930	14	5,577,200
English, Private Trade included	18	13,480,691	27	20,610,919	29	22,096,703	27	20,141,745	21	17,991,032	25	22,369,620	11	13,185,467	16	16,005,414	18	20,728,705	21	23,733,810
Total	31	29,891,591	41	31,957,939	44	36,425,603	42	31,206,445	42	28,258,432	35	25,404,280	23	19,480,397	35	25,408,614	30	26,165,635	35	29,311,010

* Most of these foreign ships went to China, previous to the commutation act, which passed into effect in England in September 1784.

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An Account of the several Sales of the East India Company average Price at which each Kind was p

1830.	March Sale, 1830.			June Sale, 1830.		
	Quantity of each kind of tea sold.	Average price at which each kind was put up.	Average price at which each kind was sold.	Quantity of each kind of tea sold.	Average price at which each kind was put up.	Average price at which each kind was sold.
COMPANY'S.	lbs.	s. d.	s. d.	lbs.	s. d.	s. d.
Bohea	23,171	no price.	1 5 4/10	1,857	no price.	1 5 7/10
Ditto	1,179,249	1 5	1 6 4/10	1,401,553	1 5	1 7 7/10
Congou	.....	.....	.....	236	no price.	2 0 2/10
Ditto	1,536,754	1 8	2 2 1/10	1,657,206	1 8	2 2 6/10
Ditto	330,555	no price.	2 1 8/10	331	no price.	2 1 8/10
Ditto	2,948,536	2 1	2 4 8/10	3,191,220	2 1	2 4 1/10
Campoi	176,642	no price.	2 1 1/10	121,979	no price.	2 2 2/10
Ditto	35,370	2 4	2 4 7/10	20,805	2 4	2 5 3/10
Souchong	59,203	2 9	3 9 2/10	.....	.....	.....
Twankay	53,416	no price.	2 2 3/10	121,573	no price.	2 2 7/10
Ditto	858,207	2 2	2 4 4/10	991,566	2 2	2 4 7/10
Hyson Skin	23,450	no price.	2 2 4/10	15,389	no price.	2 3 8/10
Ditto	42,727	2 3	2 8 7/10	28,769	2 3	2 10 8/10
Hyson	3,403	no price.	3 8 1/10	21,119	no price.	4 2 4/10
Ditto	60,133	3 0	3 9 4/10	60,355	3 0	4 0 2/10
Ditto	217,518	3 9	4 1 7/10	171,194	3 9	4 5 4/10
Sweepings	.....	.....	.....	.....		
Sold	7,548,334	.....	.....	7,805,152		
Refused	277,000	.....	.....	113,959		
PRIVATE TRADE.						
Congou	.....					
Souchong	.....					
Pekoe	.....					
Twankay	.....					
Hyson Skin	.....					
Hyson	.....					
Presents	183					
Ships Stores	481	.....	.....	323		
Sold	664	.....	.....	323		
Refused	.....	.....	.....	.....		
Total Sold	7,548,998	.....	.....	7,805,475		
Refused	277,000	.....	.....	113,959		

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1830, specifying the Quantity of each Kind of Tea sold, the t which each Kind was sold at each Sale.

1830.	September Sale, 1830.			December Sale, 1830.		
	Quantity of each kind of tea sold.	Average price at which each kind was put up.	Average price at which each kind was sold.	Quantity of each kind of tea sold.	Average price at which each kind was put up.	Average price at which each kind was sold.
COMPANY'S.	lbs.	s. d.	s. d.	lbs.	s. d.	s. d.
Bohea						
Ditto	1,401,338	1 5	1 10 5/10	1,600,810	1 5	1 11 5/10
Congou	159	no price.	2 0 8/10			
Ditto	1,494,030	1 8	2 2 4/10	1,600,741	1 8	2 1 3/10
Ditto	50	no price.	2 1	17,444	no price.	2 0 6/10
Ditto	3,024,196	2 1	2 3 7/10	2,335,236	2 1	2 3 7/10
Campoi	107,933	no price.	2 1 3/10			
Ditto	31,389	2 4	2 5 3/10			
Souchong				29,443	2 9	4 4 1/10
Twankay				519	no price.	2 2 8/10
Ditto	1,083,541	2 2	2 4 5/10	1,065,236	2 2	2 3 2/10
Hyson Skin	7,082	no price.	2 3 3/10	88	no price.	2 2 3/10
Ditto	36,916	2 3	2 6 7/10	16,460	2 3	2 10 6/10
Hyson	130	no price.	4 3 8/10	10,824	no price.	4 1
Ditto	36,338	3 0	3 9 6/10			
Ditto	133,619	3 9	4 1 3/10	18,373	3 9	4 10 3/10
Sweepings				4,153		
Sold	7,356,721			6,699,328		
Refused	94,079			368,634		
PRIVATE TRADE.						
Congou	145,513	1 8	2 2 7/10	351,366	1 8	2 3 8/10
Souchong	10,633	2 9	3 8 3/10	34,208	2 9	3 5 3/10
Pekoe	89,452	2 11	4 2 1/10	82,101	2 11	4 0 7/10
Twankay	49,461	2 2	2 4 5/10	23,670	2 2	2 2 4/10
Hyson Skin	36,384	2 3	2 3 3/10	5,651	2 3	2 3 2/10
Hyson	121,108	3 0	4 1 7/10	219,401	3 0	4 1 3/10
Presents	11,311			21,338		
Ships Stores				365		
Sold	463,862			738,100		
Refused	861			109,870		
Total Sold	7,820,583			7,437,428		
Refused	94,940			478,504		

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TOBACCO.

Nicotiana. A genus of plants of the order *Monogynia*, belonging to the *Pentandria* class, and in the natural method ranking under the 28th order *Luridæ*.

THERE are seven species of the tobacco plant, of which the Nicotiana Tabacum or common tobacco is the only one which it is necessary to notice. Two varieties of this species are cultivated. These are distinguished by the names of Oronoco, and sweet-scented tobacco, and they differ from each other outwardly only in the form of their leaves, those of the sweet-scented variety being shorter and broader than the other. They are annual herbaceous plants, rising with strong erect stems to the height of from six to nine feet, their foliage being fine and handsome. When full grown, the stalk near to the root frequently attains a size greater than an inch in diameter; it is surrounded by a hairy, clammy substance of a greenish yellow colour. The leaves, which are of a light green, grow alternately at intervals of two or three inches on the stalk; they are oblong and spear-shaped; those lowest on the stalk are about twenty inches long, and they decrease in size as they ascend, the top leaves being only ten inches long, and five broad. The young leaves, when about six inches long, are of a deep green colour, and rather smooth; but as they approach maturity, they assume a yellowish tint and have a rougher surface. The flowers grow in clusters from the extremities of the stalks; they are yellow externally, and of a delicate red within; the edges, when they are full blown, rather inclining to purple. These flowers are

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TOBACCO — (NICOTIANA TABACUM.)

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succeeded by kidney-shaped capsules of a brown colour, each one of which contains about 1000 seeds, so that the whole produce of a plant has been sometimes estimated at 350,000 seeds.

The plant was first discovered by the Spaniards in America, about the year 1560, and being sent to Spain first from Tabaco in Yucatan, took thence the name by which it is now so generally known. Its more botanical designation is derived from Jean Nicot, Lord of Villemain, who was ambassador from France to Portugal about the time when this produce was first brought to Europe, and conveyed the plant to his own country. Sir Walter Raleigh is generally reputed to have first introduced it into use in England, in the year 1585.

It has been very generally held that tobacco is indigenous to Virginia, because Thomas Harriot, who was sent to that country by Raleigh at the time just mentioned, found the plant then cultivated and in use among the Indian population. Some persons who have investigated the subject, incline nevertheless to the contrary opinion, and believe that the plant is not native to North America; but gradually found its way thither from South America, through the ultimate agency of some migratory tribes of Tlascalans, who are said to have crossed to the eastward of the Mississippi about the time of the conquest of Mexico by Cortez. In support of this opinion, Mr. Tatham, who resided during thirty years in the tobacco-growing districts of North America, and was much in the then unsettled parts of the country, declares that he never once met with any tobacco growing wild in the woods, although he often found a few plants springing up spontaneously about the grounds of deserted habitations, and where most probably it had once been cultivated.

Tobacco is, perhaps, an object of more general use than any one other production of the vegetable kingdom; and if we consider that in no sense can it be classed among articles necessary for human subsistence, this fact is calculated to excite our surprise as well as interest. The love of tobacco is evidently an acquired taste; yet it is one so easily and universally acquired, that this weed forms a luxury which is en-

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joyed in common by the African negro, the unclothed and houseless wanderer of Australia—the hardy American Indian —the slothful Asiatic, and every class of people throughout the more polished countries of Europe.

The great bulk of the tobacco which enters into the commerce of the last-mentioned portion of the world, is grown in the United States of America, and of these states Virginia is the one where it was long most extensively produced. The processes followed for its cultivation and preparation in that quarter, are so similar in their details to the methods pursued in most other countries, that if a description be given of the plans of the Virginian farmers, it will not be necessary to enter upon the like explanations with regard to the operations of any other tobacco growers.

The colonization of Virginia was effected under a royal charter granted by James the First, in the year 1606, but it does not appear that the settlers gave their immediate attention to the production of tobacco. It was not until ten or twelve years after that period that the shipments of this article from Virginia to Great Britain were of sufficient moment to cause them to be in any way recorded; and in 1621, the whole growth in the colony amounted to no more than 60,000 pounds; the production was then, however, increased by the governor, Wyatt, who obliged every individual emigrant arriving in the province, to raise at least a thousand tobacco plants. In 1624, its cultivation received a further and more powerful impulse from the proclamation of the above-named monarch, which ordered that thenceforth no tobacco should be grown in Great Britain, and that none should be imported other than was the produce of Virginia and Bermuda.

The prohibition thus placed upon the growth of tobacco in the mother country, was not intended so much for the advantage of the colonists, although it really produced that effect, as it was to facilitate the collection of revenue upon the article, it being evidently more easy to levy a duty at the Custom House upon importation, than to collect a tax from every farmer in the country who might be disposed to cultivate tobacco.

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In the following reign the trade in tobacco was converted into a strict monopoly in the hands of the monarch, who paid such a price to the colonists for their produce, as effectually encouraged them in its cultivation, while he resold their shipments to his subjects at home, at prices fixed according to his own will.

The production of this article appears to have been increased by this means in a more rapid ratio than the wants of its European consumers, and the consequent distress that visited the planters must needs have been great, since it induced them in 1639, to pray for the enactment of a most extraordinary law on the part of the legislature of the colony.

This act commences by reciting, that the planters being plunged into debts and difficulties by reason of the excessive quantity of tobacco planted in the colony, and the low price obtained for the same, it had been proposed as a means of enhancing the total value of their produce, that the whole growth of the then present year should be destroyed, with the exception of one million two hundred thousand pounds weight, and that a similar course should be adopted with respect to the crops of succeeding years. The legislature "having weighed the aforesaid proposition, and taken into consideration the vast quantity of tobacco both in England and all other places where the commodity hath been formerly vended, to which, if all the tobacco of this year's growth should be added, and no restraint of planting to be made for the future, it must bring assured loss to all who shall be dealers therein, both to the planters of their labours, and the merchants of their adventures"—enacted a law in conformity. Viewers were appointed, who were sworn to the due execution of the act; and who, after examining all tobacco, were to destroy in the first place, all that should appear to be of inferior quality; and thereafter, and also, in the two following years, one-half of all the good tobacco grown within the province.

This clumsy expedient for raising the value of their property by destroying a part, is not without its parallel in the conduct of the Dutch, with regard to the productions of their spice islands. In the case of the Virginians, the measure was

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indeed of a more complex nature, since nearly the whole of their business transactions were carried on by means of tobacco as the measure of value, and it is plain that the fulfilment of all existing contracts according to their letter, would have been greatly to the disadvantage of the growers, who were most of them debtors. This evil was remedied by enacting further, that every debt of one hundred pounds of tobacco then owing, should be fully satisfied and discharged by the payment of forty pounds weight, and various minor regulations were added, which, if the fact were not known by other means, would plainly prove that the producers were in this instance the law-makers also.

Every thing depends upon the proper selection of soil for the cultivation of tobacco. In none but rich lands will it ever succeed. Those said to answer best in Virginia, are "the light red, or chocolate-coloured mountain lands; the light black soil in the coves of mountains and the richest low grounds," and it is doubtless owing to variations in the soil that particular districts enjoy a reputation superior to others for the production of tobacco.

When the ground has not previously been under cultivation, and requires to be cleared of heavy timber-trees and underwood, this task must be commenced early in the autumn. The underwood, roots, and small branches, are collected together into heaps by women and children, and burnt on the ground, while the trunks of trees are sawn into lengths of about eleven feet each, suitable for forming a fence to inclose the land. The next operation is that of breaking up the soil and throwing it into shape, which is done with hoes, the clods of earth being worked until they are sufficiently fine. The mould thus broken is then drawn with the hoe round the projected leg of the labourer, forming a hillock as high as his knee, when the foot being withdrawn and the hillock perfected, he proceeds onward to form another, until the whole ground is prepared. These hillocks are raised in lines, and are usually four feet apart one way, and three feet the other.

The seed is always sown in nursery beds, or *patches* as they are called, and which are invariably made in lands of the best

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possible soil in a dry spot, but so circumstanced, that attention may be conveniently given to water the patches from time to time, according to the state of the weather. The size of these plant beds varies of course according to the magnitude of the concern. They are made ready for receiving the seed in March, or the early part of April, according to the forwardness or otherwise of the season. For this purpose large heaps of brush-wood, maize-stalks, straw, or any other dry vegetable matters are burnt upon the land, which is afterwards completely broken by digging. Some planters are accustomed to sow white mustard seed round the plant patch, as a protection from the ravages of the fly, which preferring the mustard to to any other plant, will feed on it until the tobacco sprouts are in a fit state for being transplanted. On the slightest appearance of frost, it is necessary to spread mats over the beds for the protection of the young plants; but all precautions against the inclemency of the weather are evidently unnecessary in inter-tropical climates, where the cultivator of tobacco has only to choose the period of his operations according to the more usual season for rain.

In about a month from the time of sowing the seed, the sprouts will be in a fit state for transplantation. When the fourth leaf has sprouted and the fifth is just appearing, at which stage the sprouts will be about four or five inches out of the ground, they are known to be sufficiently forward for this operation. The cultivator chooses his time when the ground has been well softened by rain, so that the sprouts may be withdrawn from the patch without risk of injury to their tender roots. This done, they are conveyed without delay in a basket to the field previously prepared in the manner already mentioned, and one plant is dropped upon every hillock. Persons immediately follow, who with a finger make a hole in the centre and deposit the tobacco plant in an upright position pressing the earth round the root with their hands, an operation which must be performed with great care, as the leaves are exceedingly tender at this time, and any injury sustained by them would endanger the safety of the plant.

So necessary an agent is moisture towards the successful

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performance of this operation, that the planters wait for a shower of rain, and prefer to complete the transplanting during the very time that the rain is falling.

In the course of a very few days most of the sprouts will, under these circumstances, give signs of their having taken hold of the ground; some few will appear, however, upon inspection, to have failed, the favourable opportunity of a shower must again be waited for, in order to supply their places, and attention must be given to this point until all deficiences are filled up, and the plants are proceeding satisfactorily throughout the field.

Tobacco husbandry calls for continual labour in weeding and earthing up the plants, and in constantly stirring the soil about the roots, and these labours must be persisted in through the whole growth of the crop, to insure its receiving a proper degree of nourishment. Any dead leaves that may be found from time to time attached to the stalks must also be carefully removed.

The period when the flower branches first begin to appear, differs according to soil and climate, but in general happens when the plants have attained the height of two feet; at this stage of their growth, they must be submitted to the operation of *topping*. This is performed by removing with the finger and thumb-nail the leading stem, which, if left, would run up to flower and seed, but in so doing would drain away a large portion of the nutritive juices from the leaves, to increase the size of which is the object of the cultivator, and this he strives to assist by every means in his power. When this source of exhaustion is removed, the leaves will absorb the whole nourishment which the plant receives, and will become thicker and heavier and in every way superior.

In topping the plants, it is usual in Virginia to allow from five to nine leaves to remain on the stem, according as the quality of the soil is fitted to perfect a less or greater number, but it is seldom that so many as nine can be left with advantage. In general the fewer the number of leaves that remain, the stronger will be the tobacco, and it by no means follows that by increasing the number, the weight of the produce will

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also be increased. This topping process is better performed by the hand than with any cutting instrument, because the pores of the extremity are better brought together, and the wound is healed sooner and without much loss of the juices of the plant.

Another kind of pruning is incessantly called for. Near to the junction of the leaves with the stem, and also about the root, superfluous sprouts, called suckers, continually shoot forth, and if permitted to grow, materially injure the quality of the tobacco; they must consequently be removed and for the reason already given, the finger and thumb-nail form the most appropriate instrument for this "suckering" process also. It would in many cases be practicable to procure a second crop of tobacco from the same plants by means of suckers proceeding from the root, but the produce thus obtained would also be very inferior in quality.

The plant is liable to injury at various periods of its growth from the ravages of grubs, some of which attack the roots, and others the leaves. One species of these insects, the horn-worm, or large green tobacco-worm, is particularly mischievous. Whenever these enemies appear, they must be destroyed by any means within the power of the cultivator, the most efficacious of which is to remove them individually from the plants and crush them under foot, an unpleasant and laborious operation.

These caterpillars are greedily devoured by turkeys; large flocks of which, are sometimes kept by cultivators, and are driven into the fields where they prove more useful in removing the insects than even a considerable number of hands. The ground-worm, which attacks the plant under the surface of the ground, must be sought for and destroyed.

Tobacco encounters also another injury, which appears under the form of blight, and is occasioned by the long continuance of either extremely wet or dry weather. This disease, which is called firing, is much dreaded by the planters. When it appears, the leaves perish partially in spots, and thus diminish the weight of the crop. The injury sometimes shows itself in the field, and at other times in the curing-house.

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In this latter case it may be mitigated by the employment of artificial heat for drying the leaves.

It is hardly possible to describe the particular appearances of the plants, which determine the fact of their being in a fit condition for being cut and gathered in; experience will alone enable the cultivator to seize upon the properest moment for harvesting. When fully ripe the leaves change their colour to a yellowish green, they put on what may be called a mellow appearance; the web of the leaf (owing probably to a contraction of its fibres) appears more prominent, and it is somewhat thickened in its substance. The requisite amount of experience upon this point, is indeed soon gained by the observant cultivator; but at first it will always be better for the young planter to seek the advice of some one already possessed of that experience, rather than act upon his own unaided suggestions. In more tropical climates, the motive which principally incites to vigilance in this respect in Virginia, is wanting. If frost should be experienced while yet the plants are on the ground, farewell to all the hopes of the planter: the destruction is entire and irremediable.

As all the plants throughout the same field do not arrive together at their full maturity, the charge of cutting them is assigned to clever and experienced hands. Each of these is furnished with a strong sharp knife, and proceeding regularly along the rows of plants, selects and cuts only such as appear to be ripe, leaving the rest for future and successive operations. If tobacco be cut before it is fully ripe, it will not assume a good colour in the curing, and will besides be liable to rot when afterwards packed in hogsheads.

The cutting takes place near to the ground. Such plants as have stalks sufficiently thick are then cut down the middle so as nearly to divide them, and this is done that the air may be admitted more freely to every part of the leaves during the after process of curing. By this means too, the plant is more readily freed from a part of its natural moisture, and is thus rendered less liable to undergo fermentation whereby the quality of the tobacco would be injured. When thus cut and divided, they are laid down in regular order on the spots where

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they grew, the extremities of the leaves all pointing in the same direction, that they may be more easily gathered up. This operation is performed as soon as the sun has produced a sufficient effect upon them, and they are found to have lost their freshness and rigidity. The same effect is sometimes produced by laying the leaves in bulk upon logs before they are conveyed under cover.

The building appropriated to the reception and curing of tobacco is a kind of barn, its size being made according to the extent of ground under cultivation. Where this is great, and more than one building is consequently required, barns are usually erected on several spots contiguous to the different tobacco grounds. The most usual size given to these buildings is from forty to sixty feet in length with a proportionate width, and their height to the eaves of the roof is twelve feet. The sides are left partially open to allow a free circulation of air, and the internal area of the building, including the roof, is occupied by horizontal poles stretching across the barn in a parallel direction and four feet apart from each other. These poles are connected together when the house is occupied, by cross pieces which are called *tobacco sticks*, and upon these the leaves are hung in order to be cured. There are three several tiers or stages of these poles and sticks in the principal area of the house, besides others in the roof, a perpendicular space of four feet being preserved between each stage for the proper circulation of air.

It cannot be necessary to offer any further directions for the construction of tobacco-houses. The object which they are intended to fulfil being borne in mind, their material and form must be left to the discretion of the cultivator, and to the local capabilities afforded for the purpose. Of course the roof must always form a perfect protection against the weather, and it will be necessary so to contrive the poles and sticks, that they may be removed and replaced without difficulty.

The plants must be removed into the tobacco-house so soon as they become sufficiently pliant to bear handling. If taken from the field at the moment when they have been cut, such

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is the rigidity and brittleness of the leaves, that they would be much broken and damaged. The removal is effected by manual labour, and that quantity of leaves which can be conveniently carried by one person is called a *turn*.

The operation of hanging is then performed by suspending the plants upon the sticks with the points of the leaves downwards, resting them either by the stalk of the lowest leaf, or by the slit which has been made in the stem of the larger plants as before described. The whole are made to hang four or five inches apart from each other upon the sticks, the exact distance being proportioned to their size.

The sticks thus occupied are then, by means of ladders, conveyed to the places it is intended they shall occupy between the poles, the buildings being filled with them progressively from the roof downwards.

The agency of the atmospheric air is principally relied on for the curing of tobacco; but as it is important to maintain something approaching to an uniform temperature, and to be particularly watchful as regards the dryness or dampness of the air, it is necessary for the planter to bestow his constant attention upon the weather, in order to remedy as far as possible the effects of atmospheric changes. If too much moisture is seen, small smothered fires are made with rotten-wood or bark at various spots on the floor of the curing-house. Much care is needed to prevent the blazing of these fires, as any sudden heating of the leaves while in a moist condition would produce a disease similar to that already described under the name of firing.

When the curing has proceeded to a sufficient extent, the tobacco is said to be *in case*, an effect which is generally produced in about four or five weeks after it was first hung in the building. The method employed for ascertaining whether this point has been attained, is to stretch the leaves gently over the ends of the fingers and knuckles; if the tobacco be in good case, the leaves will then be found elastic and tough, and slightly covered with a glossy kind of moisture. After this effect has been produced, the first rainy day is chosen for taking down the leaves, which are next withdrawn from the

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sticks preparatory to their being stripped from the stalks. For this purpose, a numerous party of negroes—men, women, and children—are seated in a circle on the floor of the tobacco-house; and as they draw the leaves from the stalks, hand the former to two men placed in the centre, who distribute them into separate heaps according to their qualities. The lower or ground leaves being generally soiled and torn, are for that reason separated from the rest; while of those produced on the higher part of the stalk, some are inferior to others; the whole are, therefore, distributed into three heaps. When this separation has been effected, a number of leaves are tied to gether at their thickest ends, a small leaf being employed for that purpose by twisting it round the others, and securing its end in a kind of knot: each little bundle thus made is called a *hand*, and is somewhat thicker than a man's thumb, at the end where it is tied.

It is necessary to choose rainy or very damp weather for handling tobacco, otherwise the leaves will partially crumble into dust, and much loss will be thereby sustained. When once the leaves have been properly cured, it does not much signify whether the place in which it is stored be damp or otherwise, for however dry the leaves may become in hot and fair weather, the return of rain never fails to restore to them so much toughness, that they may be handled without injury.

When the little bundles are thus made, they are thrown together in heaps on a wooden platform, where they undergo the process of sweating; this amounts to a slight degree of fermentation, and care must be taken, through exposure to the air, to check this from proceeding too far: as to this point experience will be the only proper guide. The leaves, when the sweating has subsided, will once more show an elastic quality when stretched between the fingers. The tobacco is then considered to be sufficiently *in case*, and fit for being packed for shipment. The leaves are sometimes deprived of their stalks previous to their being packed, an operation which is performed for various causes. If the plant has exhibited any symptom of blight during its growth, or if the season has

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been less favourable than usual, experience has taught the planters that the stalks are liable to decay, an event which would prejudice the saleable value of the tobacco. These stripped leaves are besides more esteemed in some markets, so that the enhanced price which they bring will more than make good the loss of weight, and pay all the expense of stripping. The operation is performed by taking the leaf in one hand, and the extremity of its stem in the other, in such a manner as to tear them asunder in the direction of the fibre; and, although, this appears a very simple process, expertness in it is only to be acquired by practice. Leaves thus stripped, are made up into bundles, and in other respects are treated in the same manner as the more perfect leaves. In former times, the stalks were thrown aside as refuse, but for many years past, some particular kinds of snuff have been prepared wholly from them, so that they find a ready market, if in a sufficiently sound condition to be manufactured.

In proceeding to pack tobacco for shipment, it is necessary to adopt mechanical aids to labour for compressing it, so that the space it would otherwise occupy, and with it the expense of transporting it, are very materially reduced, while the air being pressed out, the tobacco is rendered less liable to external change; and its body being made compact, it is less penetrable by moisture, and less exposed to other injuries from without. Well packed tobacco acquires by this means so great a power of resisting the entrance of moisture, that instances have occurred where vessels have been stranded, and their cargoes of tobacco, although long covered by sea-water, have yet been found on examination to be only very partially damaged on the outside, the middle, from one or two inches inward, proving perfectly sound and dry.

This advantage it is on every account quite necessary to attain. There is, however, a limit beyond which pressure would prove hurtful, bruising the leaf and destroying its texture, and some judgment and experience are called for to regulate the operation.

It cannot be necessary to give a particular description of any apparatus employed for effecting the necessary compression of

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tobacco in the casks. The principle upon which any such contrivance must be constructed, is that of a weight whose efficacy may be increased at pleasure by means of a lever of the second kind, its fulcrum being at one end, while the power is applied at the other, and the compressing weight is placed between the two.

It is not requisite that the casks should be made perfectly tight, and, in fact, tobacco hogsheads never are so made. But they must be constructed, both staves and heading, of well-seasoned wood, otherwise they will be liable to shrink and may fall asunder; so that, although their contents should continue free from any other evil, they would be exposed to plunder. Immediately before packing them, it is adviseable to remove any dampness which the casks may have acquired, by either exposing them during an hour or two to the rays of the sun, or by placing them over burning shavings.

In proceeding to pack a cask, the little bundles, or hands, are ranged one by one parallel to each other across the hogshead, their points all placed in the same direction. The next course, or layer, is reversed, the points being in the opposite direction to the first. Any vacant spaces that may be thus left, are supplied with small bundles, so that the surface is rendered perfectly level: the thick ends of all the hands are placed nearest to the sides of the cask.

When a sufficient number of layers has been thus arranged within the cask, so as to occupy about one-fourth of its area, the lever, or *prizing* apparatus, as it is called, is brought into action, and being pressed down by means of an adequate weight, the quantity of tobacco, just mentioned, will be compressed into the thickness of about three inches. When the lever has been brought to its position, it must be kept there until such time as the tobacco under compression will permanently retain its situation, after the weight is withdrawn; an effect which will not be produced until after several hours. Fresh layers of hands are then added, followed by a fresh application of the prizing lever, and thus the process is conducted until the cask is filled.

A great loss of time will be experienced by this mode of

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packing, unless several casks are placed under operation at the same time, so that the packers need not remain idle.

The size of a tobacco hogshead, such as is commonly used by the Virginia planters, is forty-eight inches long, with the heads thirty to thirty-two inches diameter, and into one of these casks, from 950 to 1000 pounds weight of tobacco may very properly be packed.

Tobacco is very generally cultivated throughout the East, and particularly in the northern and western provinces of India. Although the cultivation is more laborious than any other branch of agriculture pursued there, while the produce from an acre of land scarcely equals one-third of that produced from the same area in America; yet such is the low rate of wages paid in those districts, that it is said, tobacco may be purchased in many parts of India at a price below three halfpence per pound: the flavour of the Indian leaf is weaker than that of American growth, which circumstance is attributed to the want of skill on the part of the curers, rather than to anything unfavourable in the soil or climate.

Perhaps no plant of European introduction is in such general request as this throughout India; its consumption being almost universal among the inhabitants of the Indian islands, who grow all that they require for their own use, while some produce a surplus quantity for exportation. The introduction of tobacco into that quarter is ascribed to the Portuguese settlers, numerous communities of whom were established in the Indian seas at the time when the plant first became known in Europe.

The native annals of Java mention, that smoking was first introduced into that island by the Dutch in 1601. A considerable quantity of tobacco is now exported from that island by Chinese cultivators. Although this plant arrives at perfection in the hot plains and valleys of Java, it so far gives evidence of its more northern origin, as to require to be first raised from seed upon the cooler mountainous tracts of the island. This circumstance occasions a peculiar arrangement; two perfectly distinct classes of husbandmen being engaged in the cultivation. The seedlings are raised and sold by

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the mountaineers to lowland farmers, who perfect the plants and again dispose of the seed to the former class. This plan is found necessary in order to preserve the plants from degenerating, which they would do if the seed were sown at once in the hotter districts, while on the other hand, the soil of the mountains is ill adapted for maturing the plants.

This is not the only peculiarity attending the raising of tobacco by the Javanese, the extraordinary fecundity of whose vallies enables them to draw from it two annual crops, one of rice and the other of tobacco, after gathering which the fields are again submerged, and sown with rice. The only dressing which the land receives, is from this submersion, and its only relief is derived from an occasional fallow for half a year. The tobacco seedlings are transplanted in June, and the crop is reaped in October and November, before the setting-in of the rains.

The fertility of the soil over nearly the whole surface of this fine island is such, that if the industry and agricultural knowledge of the inhabitants were at all commensurate with it, no spot of equal extent, on the known habitable globe, would exceed, or perhaps even equal, Java in the variety, the quantity, or the value of its vegetable productions. For the most part, however, the land is either wholly neglected or subjected to very inefficient modes of husbandry, a state of things which may be referrible in some degree to the very advantage here pointed out, and which as it enables the inhabitants by means of an inconsiderable amount of toil to provide sufficiently for the few natural wants to which their desires are limited, encourages that spirit of indolence so liable to be induced by the climate. It is to be feared, however, that other causes are at work to repress their industry, and that the salutary and enlightened measures which were begun by Sir Stamford Raffles, during the period when the government of this island was entrusted to his hands, are not continued by its present possessors. The Dutch, although generally clever and successful in the prosecution of commercial enterprizes, and by no means chargeable with apathy on the subject of good government at home, have never been fortunate in their

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management of distant colonies. They appear to have always sought to snatch from them the greatest present advantage which they were capable of yielding, rather than to have fostered their capabilities by a little prudent forbearance. Their system has been restriction, instead of encouragement; they have proved themselves the task-masters rather than the protectors of those among whom they have settled. As a necessary consequence, instead of that confidence which should grow up as the fruit of continued intercourse, the natives, under their government, have either sunk into the apathy of despair, or have been goaded by the incitements of revenge, to acts of open hostility.

The superior knowledge of Europeans, which enables them in the first instance, to acquire an ascendancy over the native inhabitants of their foreign settlements, should, upon every principle, not merely of humanity, but even of policy, be employed in adding to the comforts and enlarging the minds of those among whom they establish themselves. By extending to them the blessings of security and even-handed justice, these might be encouraged to the adoption of habits of industry. The certainty of enjoying the fruit of their labours, would give them a desire of realizing the advantages of property; they would advance themselves in the scale of civilisation, would become better subjects and more productive labourers, and by these means would give a greater impulse to that commerce, which is the principal aim and end of colonization.

Although tobacco will grow and arrive at perfection in all warm and temperate climates, it succeeds far better in some situations than in others. With the exception of a small spot in the island of Martinico, where that peculiar flavoured leaf, celebrated under the name of Macuba, is produced, the tobacco of Cuba is perhaps the finest in the world. The produce of the Rio Negro, and of Cumana, is also of a superior aromatic quality. That known in commerce as Varinas tobacco, and which is grown in the Nuevo Reyno de Grenada, has likewise acquired a high reputation.

Sir Hans Sloane, in his "Natural History of Jamaica," has

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stated, that before the English took possession of that island, the Spaniards grew tobacco there, which equalled in its quality any which they drew from their other intertropical possessions, and that they were very careful by their mode of cultivation, to maintain the reputation which it had acquired, but that their English successors, not taking sufficient care of their seeds, the best sorts were lost.* If this statement be correct, and there is no reason to doubt that it is so, how easy would it be to recover this lost advantage, by procuring seeds of every quality that is esteemed. Nor is it at all unlikely that other neighbouring islands might be found equally well adapted for producing the finest qualities of the plant.

The methods pursued in cultivating and curing the tobacco, which is known in the markets of the East as Shiraz tobacco, and which is there highly esteemed for the delicacy of its flavour and its aromatic quality, are thus described by an intelligent eye-witness:

"In December the seed is sown in a dark soil, which has been slightly manured, (red clayey soil does not do.) To protect the seed, and to keep it warm, the ground is covered with light thorny bushes, which are removed when the plants are three or four inches high; and during this period, the plants are watered every four or five days, only, however, in the event of sufficient rain to keep the soil well moistened, not falling. The ground must be kept wet until the plants are six or eight inches high, when they are transplanted into a well moistened soil which has been made into trenches for them, the plants being put on the tops of the ridges ten or twelve inches apart, while the trenched plots are made, so as to retain the water given. The day they are transplanted, water must be given to them, and also every five or six days subsequently, unless rain enough falls to render this unnecessary. When the plants have become from thirty to forty inches high, the leaves will be from three to fifteen inches long. At this period, or when the flowers are forming, all the flower capsules are pinched or twisted off. After this opera-

* Vol. i. p. 146.

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tion, and watering being continued, (and irrigation is the system universally employed throughout), the leaves increase in size and thickness until the month of August or September, when each plant is cut off close to the root, and again stuck firmly into the ground. At this season of the year, heavy dews fall during the night; when exposed to these, the colour of the leaves changes from green to the desired yellow. During this stage of course no water is given to the soil.

"When the leaves are sufficiently yellow, the plants are taken from the earth early in the morning, and while they are yet wet from the dew, are heaped on each other in a high kupper house, (a shed, the walls of which are made with light thorny bushes or such like), where they are freely exposed to the wind. While there, and generally in four or five days, those leaves which are still green, become of the desired pale yellow colour. The stalks and centre stem of each leaf are now removed, and thrown away, the leaves are heaped together in the drying-house for three or four days more, when they are in a fit state for packing. For this operation the leaves are carefully spread on each other and formed into sorts of cakes, the circumference from four to five feet, and three to four inches thick, great care being taken not to break or injure the leaves.

"Bags made of strong cloth, but thin and very open at the sides, are filled with these cakes and pressed very strongly down on each other; the leaves would be broken if this were not attended to. When the bags are filled, they are placed separately in a drying-house and turned daily. If the leaves are so dry that that there would be a risk of their breaking during the operation of packing, a very slight sprinkling of water is given to them to enable them to withstand it without injury. The leaf is valued for being thick, tough, and of a uniform light yellow colour, and of an agreeable aromatic smell.

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RICE.

Oriza, from the Arabic word *éruz*—of the class *Hexandria*—order, *Digynia* — belonging to the natural order *Gramineæ* or Grasses.

THIS grain is supposed to be indigenous to Asia, and perhaps to some parts of Africa.* It has from time immemorial formed the staple article of food of the great mass of the vast population of China, and of a large proportion of the natives of India and the adjacent isles. In Egypt, and other parts of Africa, it likewise constitutes a principal source of nourishment. Rice is also cultivated in the southern parts of Europe, and very extensively in Carolina in North America. Its introduction into the Western hemisphere is comparatively of recent origin; dating from the latter end of the 17th, or beginning of the last century, and this was rather the result of accident than design. The account received is, that a vessel from Madagascar, happening to put into Carolina, the captain gave to a resident there a small parcel of seed-rice, which by chance he had among his stores. Part of this being sown, a very good crop was obtained; the manner of freeing it from the husk, however, was but imperfectly known until some time after its production there. The produce of the first harvest was widely dispersed for

* Its native place, like the other sorts of grain in common use, is not accurately ascertained. Linnæus says, *habitat forte in Æthiopia*; but "I do not," says Miller, "know what authority he has for this assertion. By a mistake he has generally put Æthiopia for the country about the Cape of Good Hope, but perhaps he may here intend Abyssinia."

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cultivation over the province,* and shortly, from the result of various experiments and observations, the rice grown in Carolina became much superior to that of the country from which the seed was originally obtained; so that it soon was considered to be naturalized as a production of the soil, and to excel all other rice in quality and value. Of so much importance was this new source of prosperity esteemed by the Carolinians, that the Captain, by whose means the cultivation of rice had been introduced, was presented with a handsome gratuity by the landed proprietors, in acknowledgement of the service he had rendered the province. It is said, that nearly simultaneously another small parcel of rice-seed was sent to America by Mr. Dubois, the treasurer of the East India company: this was likewise successfully cultivated; whence arose the two different kinds of rice grown in America — the white and the red — so distinguished from the colour of the pellicle which encloses the seed: when divested of this, both kinds of grain are white alike, and similar in appearance.

Many situations in Carolina are peculiarly favourable to rice-cultivation. The marshy land, occasioned by the inland floodings of the rivers, and that caused by the periodical visits of the tides, are equally well suited for its production. These natural advantages not only enable the cultivator to produce this grain at a trifling cost of labour, but also of a much finer quality than in those lands which are artificially irrigated. Carolina rice is well known as being of a finer, handsomer grain than that which is grown in the country of original production.

Rice is an annual plant, rising with a round jointed stalk, similar to that of wheat, but the joints are more numerous: its height varies from one to six feet, according to the variety. The leaves are subulate, linear, and reflex, embracing the stalk — they are not unlike those of the leek. The flowers are in a terminating panicle, and are succeeded by single oblong seeds, borne on separate pedicles, which spring from the main stalk of the panicle or ear. The grains are en-

* On the importance of the British Plantations in America.

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RICE — (ORIZA SATIVA) : *a* — a single ear.

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veloped in rough yellow husks, and from each proceeds an awn or beard; within the husk is a thin pellicle. The whole of the ear more nearly resembles that of oats than any other of the grain-bearing plants grown in England. These seeds, divested of their husk and pellicle, are the rice of commerce. Before they are husked, they are called *paddy*, or more correctly, *paddee*.

The varieties of rice, as of many other cultivated grains, are innumerable. Being the general food of the lower class of the inhabitants over so many regions, differing essentially both in climate and soil, varieties have been produced, distinguished from each other by their external appearance, size, and colour. Heyne enumerates twenty-one varieties grown in the Mysore alone, each distinguished by a peculiar name and characteristic. All the varieties of rice are classed under four principal kinds, and these again are divided and subdivided without end. But the points of difference are so unimportant — not in any way affecting the chemical or alimentary properties of the grain, that these four kinds may be considered rather as varieties than as species, since they may reasonably be supposed to have arisen from differences of soil, culture, and climate.

Common rice—*Oriza sativa*—thrives only on marshy ground. Should the soil on which it is grown be deprived of moisture before it arrives at maturity, it withers and dies. But where nature or art has furnished the means for constant irrigation, this variety grows with the greatest vigour, and is the most advantageous for cultivation.

Early rice—*Oriza præcox*—is likewise a marsh plant, thriving only in humid situations. It does not attain to an equal size, but its period of vegetation is much more rapid than that of the common rice; coming to maturity under ordinary circumstances two months earlier. The first yields the most prolific crop; but on the other hand it requires a richer soil, and produces only one crop annually, while if well watered two crops may be obtained of the early rice, even on inferior land.

Mountain rice — *Oriza mutica* — has the culm more slender than the other kind, and rarely attains to more than three feet

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in height. Both the seeds and awns are longer in this than in any other of the varieties. It finds a congenial situation on the slopes of hills, where it can receive moisture only occasionally. This variety is unknown in the western parts of India. It is cultivated in Cochin China and in Java. It is found to bear a much colder temperature than the two former varieties, and will grow in situations and climates where the others would not succeed.

Some specimens of rice grown on the cold mountains of Nepal were a few years back sent to this country through Dr. Wallich, the scientific successor of Dr. Roxburgh. From inspection he recognized them as the seed of the *oriza mutica*, which, from all the information collected on the subject, appears to be capable of sustaining, without injury, a great degree of cold. If the young plants have risen five or six inches above the surface of the ground before this is covered with the snows of winter, the crop is then usually past injury.

Sir Joseph Banks made several experiments on the cultivation of mountain rice in England, and as it flourishes under some circumstances through much cold, it was supposed that these attempts would have been followed with success. The result however proved otherwise. Six different samples of this rice were each sown in separate compartments in the most favourable situations. The grains were sown very thin in the middle of May, and they soon put forth a most luxuriant vegetation, each root tillering so much, that the ground was entirely covered with the grassy verdure of the plants. The blades grew vigorously, attaining to the length of two feet; but the stalks showed no disposition to rise, and unless the ground were kept constantly moist, either by natural or artificial watering, the plants drooped. They continued to vegetate thus, until an early night-frost in September entirely destroyed them. Some few of the plants had been transplanted into pots, and placed in a hot-house, but in this situation they soon died. Other plants, which had been originally reared in a hot-house, succeeded in sending forth flowering stalks, which bloomed, but the blossoms never fructified. These experiments led Sir Joseph Banks to conclude, that

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though rice would not succeed in this country as a grain-bearing plant, it might, perhaps, be advantageously cultivated as fodder for cattle, because it furnished such an abundance of blades. Since the above unsuccessful experiment, a crop of rice has been obtained in England on the banks of the Thames, near Windsor.*

Clammy rice—*oriza glutinosa*—is an intermediate variety between the mountain-rice and the other kinds; growing alike on wet and on dry land: and ripening sooner than some, but later than other kinds.

The periods of the different varieties coming to maturity depend very much on the climate and the subvariety employed in cultivation. The common rice is from three to seven months coming to maturity, according to circumstances. The finer kinds are not only less productive than the coarser, but they require a longer time for ripening. It is said, that one of the coarsest varieties is ready for cutting down in six weeks after the time of sowing it. The rice most generally cultivated in India, ripens in from four and a half to five months, and two crops are annually expected. The natural seasons of rice are ascertained from the progress of the wild plant, which sows itself in the first months of the winter, and vegetates with the early moisture at the approach of the rains. During the period of the rains it ripens, and drops its seed with the commencement of winter.

The Chinese conduct this cultivation with great care, endeavouring in this, as in all the offices of husbandry in which they engage, to draw from the soil the greatest possible produce. In Du Hamel's excellent treatise on husbandry, we find a detailed account of the method of cultivating this grain in China.†

The care of the cultivator begins before the seeds are placed in the earth. The grains destined for that purpose are put in baskets and immersed in water, in which situation they remain for some days; this softens them and tends to hasten their

* Loudon.

† Culture de Terres, tom. ii. p. 180.

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germination. The land which is to be sown with this crop is previously saturated with water until the surface is like soft mud. In this state it is stirred with a plough of very simple construction, to which is yoked a single buffalo. A rude kind of hurdle, drawn also by one buffalo, succeeds the plough, the driver sitting on the hurdle to increase its weight, by which means the clods are broken down and the ground made smooth. All stones are carefully removed, and as far as possible every weed is extirpated. Water is then again let in upon the land in just sufficient quantity to cover its surface, and a harrow with several rows of great iron teeth still further smooths and completes the preparation of the ground. Only those grains which have sprouted in the water are selected for sowing, since, as they have begun to germinate, their goodness is ascertained: all the rest are rejected.

The seed is sown thickly and evenly on only part of the ground, this serving as a nursery to the rest. A day after the seeds have been sown, the points of the plants appear above the surface of the ground. As soon as the plants have acquired a little strength, they are sprinkled with lime-water for the purpose of destroying insects which might otherwise prey upon the young shoots. This operation is performed with a small basket attached to a long handle, the basket being filled by immersion in another vessel, it is moved over the plants, and the fluid runs through and is thus distributed equally over them.

The use of lime-water is considered by the Chinese to be so beneficial, that it is said they hold the first inventor of this practice in the highest veneration.

When the young plants begin to appear in thick vegetation, they are thinned; the superfluous plants being carefully taken up with their rootlets, and transplanted in a quincunx order in the unoccupied portion of the land, which has been prepared for their reception. No delay must take place in this work, so that the plants may be as short a time as possible out of the ground: a calm day is usually selected for the purpose. As soon as completed, the water is admitted to overflow the plants. For the advantage of irrigation; the rice

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fields are usually situated near to a rivulet, pond, or other water, from which they are separated only by a bank, and through this a communication is readily made. Sometimes, however, it happens, that the water is below the level of the fields; in this dilemma, the moisture so essential to the success of the crop is supplied by means of buckets, which is a most tedious and laborious operation. The grounds are kept perfectly clean from weeds, which are taken up by the roots with the hand, although the soil is in such a swampy state, that the labourers employed in this task, cannot step upon the ground without sinking knee-deep; the maturity of the grain is known by its turning yellow in the same manner as wheat; it is then cut with a sickle, tied in sheaves, and conveyed into sheds or barns where it is threshed with flails very similar to those used in England. The machine usually employed in China for divesting the rice of the husk has been of exactly the same construction through a long course of ages; it is exactly similar to that used in Egypt; the moving power of the one being water—of the other, oxen. This mill, and the Egyptian plough of modern times, are considered by persons who are fond of such investigations, to be precisely of the same construction as those employed in that country two thousand years ago. The mill * consists of a long horizontal wooden axis, having cogs or projecting pieces made of wood or iron fixed upon it at certain intervals; this axis is turned by a water-wheel, and at right angles to it are fixed as many horizontal levers as there are circular rows of cogs. These levers act on pivots that are fastened to a low brick wall, built parallel to the axis, and at the distance of about two feet from it. At the further extremity of each lever is fixed a hollow pestle directly over a large mortar of stone or iron sunk into the ground. The other extremity extending beyond the wall, being pressed upon by the cogs of the axis during its revolution, the pestle is elevated by the action of the cogs, which as they revolve alternately, raise it, and then leave it to fall by its own gravity into the mortar. An axis of this des-

* Barrow's China.

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cription sometimes gives motion to fifteen or twenty levers at the same time.

Rice is very extensively grown in China, and, when simply boiled, is considered the staff of life.* Its cultivation is likewise pursued in Hindostan to a much greater extent than that of any other grain; it forming the principal, and for the most part the only sustenance of the contented Hindû; while it is also raised as an article for exportation. The method of culture, as practised in India, is very similar to the Chinese mode just described. Transplanting is in most cases pursued, since by that means a much more productive crop is obtained; but below the Ghauts it is often sown by hand where the plants are to remain. The ploughs used for this cultivation in Bengal are made of the *mimosa latisiliqua*, a very hard wood, which does not readily absorb moisture; the plough-share is a thin piece of iron about eight inches long, and an inch thick, which in a soil abounding with moisture is found sufficiently strong to pierce the ground and admit the plough; the share projects little more than an inch, and is obtusely pointed.

For the cultivation of the common rice, the ground must be perfectly level, as it is inundated during the greater part of the process of cultivation. In some cases, where the plains are not naturally level, they are divided into terraces; and where the descents leading down to the rivers are very steep, these terraces are not more than two feet wide. The numerous springs and rivulets which issue from the surrounding hills are conducted with great pains to irrigate these terraces.

The preparation of the rice-fields is begun in the middle of May, when they are frequently ploughed if the nature of the land will admit of this laborious operation; but when the land is disposed in narrow terraces, the hand-hoe is the only instrument used in this work; where circumstances will allow of it, the ground is manured. About three times the quantity of seed ordinarily used is scattered in a small space in a

* Hence the monosyllable *fan*, which signifies boiled rice, enters into every compound which implies eating. Thus, *tche-fan*, the name of a meal in general, means to eat rice; breakfast is called the *tsaa-fan*, or morning rice; and supper the *onan-fan*, or evening rice.—Barrow's China.

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corner of the field, where the plants remain till they are about twelve inches in height. Forty-eight pounds of seed is the usual quantity required for planting one cawny, (2400 square feet). The embankments are then repaired, and in the middle of June, when the fields have been irrigated sufficiently, so that the soil can be reduced to mud by the hoe, is the time employed for transplantation. While these works are going on, the seedlings will have become in a fit state for this purpose. They are carefully taken up by the roots and planted in the field, which is then covered with about three inches of water; and this, after standing a few days is drawn off, and a fresh supply let in. Planting a rice-field is in India a period of jollity and bustle, and the usually inactive Hindû then displays a degree of alertness and vivacity, which for a while overcomes the phlegmatic indolence of the race. "This is the grand season of business with the Hindû farmer, when his concerns absorb those of every other man in the community. He has then a prescriptive right, established by the practice and usage of some thousands of years, to call out not only the artists of the village, but their women and children to his assistance; though the hurry of business should continue a week or two."*

No artificial tool is required for transplanting rice in India; the finger is the only instrument used for making the hole which is to receive the plant. When this work is over, the plant proceeds through its different stages in a short period of time. In Behar, so rapid is the progress of vegetation, that the first harvest is ready for the sickle two months after planting. The second crop is planted in August and reaped in November, so that two harvests can be obtained from the same field.

The manner of irrigation, which is of the first importance in the cultivation of this kind of rice, varies according to the capabilities of the situation. The neighbourhood of rivers and streams, is of course preferred; but recourse must often be had to more artificial means. Immense tanks are constructed for this purpose, and sometimes the water by which the fields are kept in a humid state is laboriously drawn

* Tennant's Indian Recreations, vol. ii. p. 185.

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from wells. Heyne gives a description of a tank in the vicinity of Nabobpatam, a village near to Nandikam. This tank is of very large dimensions, being not less than three or four miles in circumference. It contains a sheet of water sufficient to irrigate an enormous extent of rice grounds. This tank is furnished with very high and broad banks, and likewise with a sluice to let out the water, a necessary contrivance both for watering the fields below the tank, and for allowing egress to any superfluous water, which might otherwise burst the banks and endanger the surrounding country by inundation during a monsoon rain, whereby, in a few hours, water enough is obtained to fill the largest tank to the brim.

In some situations the ground to a considerable extent is irrigated by wells from which the water is drawn by bullocks. This method is peculiar to India. A path, just broad enough to admit of a pair of bullocks walking abreast, is made in a steep acclivity towards the edge of the well; this path is about ten yards long or more, according to the depth of the well. Across the well are placed some pieces of wood in order to support two other pieces, between which a wheel or pulley is fixed. Over this wheel goes a leathern rope or thong fixed to the upper part of a leather or iron bucket, which ends at bottom in a prolonged flexible point; to this point a rope is also fastened and conducted over another pulley placed considerably below the other. Both of these ropes being fixed to the bullocks, when the animals move in a retrograde direction towards the well, the bucket goes down and is filled with water, and will be drawn up full when the bullocks go forward. The rope which is fixed to the flexible point, is the shorter of the two, and its length is so adjusted, that when the bucket has descended and is filled with water, the long flexible end or point will be turned up and brought in contact with the side of the bucket. As this again ascends, the rope attached to the point will be drawn towards the lower pulley, and the point will of course be drawn away from the bucket, thus gradually encreasing the angle which the two make with each other, until upon reaching the channel wherein the water is to be discharged, the bucket will be thrown over and emptied. A

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large quantity of water is raised by this method, probably not less than one eighth of a ton at a time. If the bullocks are well broken in, one man is capable of managing the whole.*

The cultivation of mountain rice does not require the employment of such expensive or laborious means for irrigation. The land on which this is to be grown is well hoed and manured: about the middle of March, at the interval of one week between each time, it is again hoed twice or thrice, and the earth is thoroughly pulverized with a mallet. Towards the middle of May, the field is once more slightly hoed after a shower of rain, and the mould is still farther broken and smoothed with the hand. Small drills, at a span's distance from each other, are then made with the finger, which is directed in its straight course by a line. At every span's length in these drills are placed four or five seeds; these are covered by the hand with a very small quantity of mould. In about five days the young plants come up. From the middle of June to the middle of August, attention is paid to the weeding of the ground, the weeds being removed with a spud. At the latter period, when the plants are about two feet high, all the moister fields of Nepal, where this rice is cultivated, are infested with slugs, worms, and insects. In order to be rid of these, the farmers usually keep a great number of ducks, which at this season are turned into the rice grounds to devour the vermin. The crop ripens in the beginning of September, and by the middle of the month the harvest is gathered in. The ears only are cut off, and the day after they are reaped, the grain is beat out from them, and dried in the sun.†

In many parts of Java, there are natural advantages attendant on the cultivation of rice, which render this a very productive branch of husbandry. Land, which can be irrigated at pleasure, fetches in that country a far higher value than any other which is not so favourably situated. The rent for land of this description is usually half the net produce, and such is its fertility, that, other circumstances being equal, its actual value is six-fold that of dry land.

The fields under rice cultivation in Java, are divided into

* Hamilton's Statistical Survey.

† Heyne's Statistical Tracts on India.

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compartments two or three yards square. These are surrounded by dikes, about a foot and a half high, for the purpose of retaining the water. The sources of supply for irrigation are generally easy of attainment, and the care of the husbandman is almost limited to the keeping of his dikes in order. No manure — no dressings of land are required. No large tanks are necessary as in most parts of Hindostan — neither is the supply of water contingent on the overflowing of the banks of rivers, as in Bengal and Egypt. The brooks and mountain streams are dammed as they descend, that their waters may be turned at pleasure on to the land to which they thus give fertility.*

Sometimes the process of irrigation is less simple. The larger rivers are dammed when they descend into the plains; to arrest the course of these becomes a work of labour and expence, which can only be undertaken by the government. Officers are appointed to superintend the distribution of the water from this source, and the owners of the lands, which are benefited by the irrigation, pay a certain tribute in kind, proportionate to the amount of crop. With wonderfully little labour, together with irrigation, "I have," says Crawford, "seen an extensive tract of waste land covered in a few months with a rich harvest." These rice grounds are always extremely prolific in produce, without ever being exhausted. Some lands have yielded, from a period beyond the memory of man, two rice crops annually; and when sown with those kinds of grain which ripen in five months, six crops have been obtained in two years and a half.

* Crawford gives an animated description of the luxuriant vegetation and the beauties of scenery attendant on this cultivation. "Slopes of hills formed into terraces — valleys almost impassable from frequency of water-courses — not an accessible spot that in the season is not covered by luxuriant harvest, and if we take into account the brilliant tints of an equatorial sky, the vicinity of mountains of ten thousand feet high, the most elevated portions of which are covered by forests of perpetual verdure — valleys thickly strewed with groves of fruit trees hiding the cottages of the peasantry — together with the peculiar richness of the rice crop, which far excels in appearance that of all the other *cereal gramina*, we may imagine that rural industry cannot well be contemplated in any portion of the globe to greater advantage." — Crawford's Indian Archipelago, vol. i. p. 352.

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The seed is scattered thickly in beds, and when the plants are twelve or fourteen days old, they are transplanted into fields in which they are thinly set by hand, and the ground is then covered with water until a fortnight before the crop comes to maturity. The water is then drawn off, which plan is thought better to promote the ripening of the ears. Land, dependent only on rain for moisture, is ploughed and harrowed on the first fall of rain, and the seed is then sown. The ploughing, harrowing, and labour of irrigation, are performed by men; the sowing, transplanting, reaping, and housing, are done by women. The harvest usually falls in the dry season, but where there is artificial irrigation, the gathering in of the crops is not dependent on seasons. It is not uncommon to be able to trace the whole progress of cultivation going on at the same time in the same field. In one compartment, ploughing and harrowing—in another, sowing—in another, transplanting—in a fifth, the grain ripening; and in the sixth, the matured rice being gathered in by the reapers.

The ears are nipped off as they arrive at maturity, with a few inches of the culm attached to them. They are then conveyed to the farm, and spread out for a day or two under the powerful influence of the sun. When sufficiently dry they are tied into sheaves, and deposited in granaries made of wicker-work, one of which is always attached to every cottage. The cattle is now turned into the land until the straw is exhausted, and previously to ploughing the ground afresh, the remainder of the stubble and dry weeds are burnt and their ashes spread on the ground.

The grain is usually carried to market in the husk, because it will keep for any length of time in that state, but husked rice is, in a damp warm climate, a perishable commodity. The operation of husking is not well understood in Java, the rice from that country always being much broken; it is also carelessly dried, but its quality is otherwise very good.

Mountain, or dry-land rice, is likewise grown in Java. This species is sown in the middle of the dry season, either by dibbling or broad-cast. No land will yield two crops annually

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of this kind: if cultivated on poor soil, a fallow of one, two, or three years, is often necessary.

The hollows between Colombo and Candy, in the island of Ceylon, are, as described by Bishop Heber, devoted to the cultivation of rice. Comparatively, however, very little of this grain is produced in Ceylon, and that of an inferior quality. It is, notwithstanding, the staple article of food to the great mass of the population, for which they are therefore dependent on a foreign supply, drawn principally from Bengal and the coast of Malabar.

The manner of cultivating rice in North America differs somewhat from the methods practised in the East. For this purpose, the ground is trenched in about the middle of March, the ridges being about a foot and a half from each other, from centre to centre. At the bottom of the trenches the seed is put in by hand, and not scattered: this office is generally performed by women. Water is then, by means of flood-gates, let into the fields, over which it flows several inches deep. It remains thus for five days, and is then drawn off, leaving the ground dry till the young plants spring up three or four inches high. In about a month after sowing it will have arrived at this state; the land is then again overflowed, and the water suffered to remain in this situation for a fortnight, that, while it nourishes the rice, it may destroy the weeds. For two months after this period the land is left dry: during that interval it is repeatedly hoed for the double purpose of removing the weeds and loosening the soil. At the end of this time water is again admitted, and the rice comes to maturity while in this situation. The gathering in of the crop commences at the end of August, and usually continues to October. It is cut with sickles by men; the task of making it into bundles devolves on women.

This branch of agriculture thus conducted, is most prejudicial to the health of the cultivators. The alternate flooding and drying of the land in a hot climate, where evaporation is rapidly going on, is extremely insalubrious. The care of the rice grounds is therefore left entirely to negro cultivators, none

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of the white population caring to expose themselves to so unwholesome an atmosphere. The hospitals are filled in the autumn with the victims to this unhealthy occupation; the destruction of life consequent on it is very great, and fresh supplies of negro slaves from the more northern slave-states are constantly required, to make up the numbers of those who are unfortunately destined to shorten their days amid the marshy exhalations of a rice ground.

Though there are few casualties attendant on the cultivation of rice in America, the crop is sometimes much injured by the incursions of the *orizivora*, or rice bird of Catesby, and known familiarly in the country by the name of Bob Lincoln. This bird is about six or seven inches long. Its plumage is a mixture of black, white, and yellow; the head and the under part of the body are black, and its legs are red.

The rice harvest of Carolina is preceded by that of Cuba, and there do immense flocks of this bird light upon the rice fields, and commit ravages on the tender grain; when this, as it approaches to maturity, becomes too hard to be agreeable food to them, they take wing towards the north, migrating in numerous parties. It is said that mariners going that course sometimes hear these birds in their flight.

The devastations committed by the rice-bird in Carolina are of serious consequence to the result of the harvest. The long flight of the birds causes them to arrive in a very emaciated state; but while feeding on the tender grain, they in a surprisingly short time regain their flesh, and at the end of three weeks, the usual period of their visit, they are so exceedingly plump as to become unwieldly, flying with difficulty. The hardening of the grain is a signal for their departure from a particular spot, and they soon appear in other parts where the rice is yet milky. When it all becomes in too mature a state for their depredations, they are forced to seek nourishment by devouring insects, till the newly formed grain of the maize marks that plant for their attacks, and on this they prey with as much eagerness as they did on the rice.

During the spring and summer, numerous flocks of the rice bird are to be seen in New York and the Rhode Islands.

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Here they bring up their young, which accompany them in their flight southward, and arrive in Cuba just as the rice is again in a fit state for their devastations.

It is remarked of these birds that the males and females do not migrate in company, the females being always the first to perform their aerial voyages.

The cultivation of rice is very extensively and successfully pursued in some parts of southern Europe. At Valencia, in Spain, this branch of agriculture is pursued, and irrigation is practised there to even a greater degree than in the hotter climates of the east. After sowing the seed, water is made to overflow the fields, and is continued there even during the gathering in of the harvest. The reapers are compelled to wade up to their knees for the purpose of cutting it, while other persons follow to receive the sheaves as they are collected, and to convey them to a dry spot, where the grain is trodden out by mules.

The rich meadows of Lombardy, over which the waters of the Po can be made to flow, are also devoted to this cultivation. The land selected for the purpose is perfectly flat, and after it is sown, is irrigated and left with the water standing on its surface several inches deep, in which state it remains during the whole course of vegetation, until the grain comes to maturity. Three successive crops are drawn from the land without manuring, but after that time it becomes so exhausted that it requires the aid of manure and an alteration of crop, before it can again with profit be devoted to rice cultivation.

Three bushels of seed are employed for sowing one acre of ground.

Land employed in this manner produces more advantageously in that country than if under any other cultivation. But this branch of agriculture is attended with the great evil of being here, as in other countries, injurious to health. The government of Milan, in consequence, restricts the cultivation of rice within a certain limit, beyond which it may not be grown.

The separation of the grain from the ear is, in most of the countries of its production, performed by means of a hand-

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flail; no machine having yet been invented whereby this work can be performed. The husk adheres to the grain very tenaciously, it is usually separated from it by passing the rice between a pair of mill-stones, at such a distance from each other as to remove the husk by friction, without crushing the grain. The pellicle is disengaged by trituration in large mortars with heavy pestles, weighing from two to three hundred pounds. In India, it is husked dry for home consumption, but scalded for exportation. The expence of fuel in the latter case is about equal to the saving of labour in rubbing off the husk when in a moist state. This work is usually done by contract in India—five-eighths of clean rice to be returned for the quantity originally given out: the surplus, together with the chaff, is taken in payment for the labour.

A considerable quantity of paddy, or rice in the husk, is now imported into England, whereby a great saving in the price is obtained. Its cost is proportionately lower in the foreign market; there is less waste experienced in the transport, and the difference in the rate of duty is very important.

It is divested of the husk better by machinery employed in this country than by the defective means used in India.

Improvements in the manner of cleaning rice have been suggested for adoption both in our Eastern dependencies and in North America. Sir Thomas Maitland, when governor of Ceylon, was so fully impressed with the inadequate nature of the mills employed by the natives for this purpose, that, on his return home in the year 1812, he recommended to the Secretary of State for the Colonies that means should be taken for sending to Ceylon machinery better suited for producing the required effect. Mr. Hoblyn accordingly lent his attention to the subject, and invented a machine which was sent out and employed with very satisfactory results. The following account of this mill is taken from the records of the Transactions of the Society for the Encouragement of Arts, &c.

"The mill consists of a strong iron frame, supporting, by columns ten feet high, a platform about twelve feet square; upon this platform there are placed, at equal distances, four pair of horizontal stones, four feet six inches diameter, driven

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by wheel-work placed under the platform, and supported by a framing of iron fixed to the columns. The mill is fixed at about ten feet from the fly-wheel of the engine, and receives its motion by means of a shaft coupled on the end of that which carries the fly-wheel, having a bearing from its other end on the framing of the mill; on this shaft is a bevil or mitre-wheel four feet diameter, with cogs working in another of the same size on an upright shaft in the very centre of the mill; there is also on this upright shaft a spur-wheel seven feet diameter, working, like the last mentioned bevil-wheel, horizontally; this large wheel has cogs or teeth in its rim which work into four pinions or small wheels, two feet six inches diameter, fitted on the spindles of the stones, and drives the four pair at once; all this wheel-work is so proportioned, that when the engine makes thirty revolutions, the stone makes eighty-four. The under-stone remains stationary, being wedged partly into a circular hole in the platform; in the centre is a hole through which the spindle comes from below; in this hole a brass socket is fixed to prevent the spindle from wearing, and the upper end of the spindle stands six or seven inches above the stone.

"The upper surface of the stone being made perfectly flat and true, and laid quite level, it is punched full of small holes about a quarter of an inch deep, and three quarters of an inch apart.

"The upper stone or runner is prepared in the same manner, and exactly balanced on the top of the spindle, with its under surface fitting perfectly true to the upper surface of the nether stone. The hole in the centre of the upper stone is large, and has a cross fitted in it to form the centre socket, which fits upon the spindle; so that, between the arms of this cross, the grain turned in can fall upon the nether stone round the centre.

"The stones being thus prepared, and the mill in motion, the upper stone revolves with great velocity, while the nether stone is fixed; the lower end of the spindle or pivot, on which the stone turns, is planted upon a strong iron lever, which can be raised or lowered by a screw, and by this means the

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falls of the stones can be adjusted by the miller, either when the mill is in action or motionless, with the greatest possible facility.

" The stones are covered by a hoop or case, which entirely encloses them, leaving a space all round between the stones of about two inches; on the top of the case is fixed the hopper, which is filled with paddy; it falls through a hole in the bottom of the hopper into a shoot, and is conveyed into the hole in the centre of the upper or running stone; it then falls through the arms of the cross before described upon the face of the nether stone round the centre. The stones being in rapid motion, the paddy finds its way between the faces of the two stones, which are now supposed to be set at the length of the grain apart, the grains are carried by the centrifugal force from the centre to the extremity of the stones, and thrown out in all directions into the case or hoop which surrounds the stones: in one side of this hoop is a hole through which the rice in this state runs out.

" The stones should be set in the first instance with great care; for if they are too near, the rice will be broken, and, if too far apart, the paddy will get through without being touched; but when set at the right distance, the husk will be completely taken off, and the rice not broken.

" One pair of stones will husk from eight to ten bushels an hour with ease; the rice runs from the cases upon a fine sieve, kept agitated by the mills; in passing over this the dust and sand are separated; it then falls into the winnowing machine which is to separate the husk from the rice: this is done by causing the husk and rice together, as they leave the stones to fall in a gentle stream through a current of air excited by a succession of fans, revolving upon an axis, and driven by the engine; in its passage through the current, the husk being much lighter than the rice, is blown away, and the rice falls into a bin below.

" There is one of these machines to each pair of stones to separate the rice from the husk in its passage from the stones to the bin; this part of the operation is most completely performed, and keeps pace with the stones.

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"The rice, in this stage of the operation, is more or less red, nothing more being done than the separation of the husk; after this it is taken to the whitening machine, where the inside cuticle or red skin is detached.

"This machine consists of a stone of coarse grit fixed on a spindle like a grinding-stone: the stone is inclosed in a box or case made nearly to fit, leaving a space all round of about an inch between the stone and the inside of the case; this case is made of plate iron, and punched full of small holes like a grater, with the rough side inwards: it is so contrived that the case may go round with the stone, or it may remain still while the stone is turning.

"The rice is put in between the case and the stone at a sliding door or opening in the rim, the space is about two-thirds filled; the stone is then put in very rapid motion, by means of a connecting strap, making at least 250 revolutions a minute; the case is allowed to turn very slowly; this changes the position of the rice, and every grain in succession comes into contact with the stone, and, rubbing hard against each other, an accumulation of heat is produced, whereby an enlargement of the grain takes place, and, consequently, the red skin is split and loosened. This, forming a red dust, finds its way out of the holes in the case, and leaves the rice perfectly white. In the whole process there is little or no loss, for when the stones are well adjusted, very few grains are broken; not more, perhaps, than five per cent. upon the whole, and those very partially."

A machine for husking rice, was patented in this country by Mr. Wilson, in 1827, purporting to be an invention from New York. We do not know how far it has been found to answer in America, but, if efficacious, it has the further advantage of simplicity to recommend it.

This machine consists of a long hollow cylinder, made of either metal or wood. At equal distances, around the interior surface of this cylinder, are fixed, in parallel circles, a series of angular bars projecting towards its centre or axis. This cylinder revolves loosely on a central shaft, which passes through it, and is provided with a similar number of bars,

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to those already mentioned, radiating from the centre to the circumference, and passing alternately between the bars in the cylinder, so as to leave, when at their nearest proximity, an inch free space between them. Thus disposed, the cylinder is placed in an inclined position (an angle of 45°). The rice flows into it at the top from a hopper, supported by a frame; the cap of the cylinder is connected thereto, and is not fastened either to the cylinder or its axis. Its office is to guide the grain into the cylinder, and to protect it from receiving dust and other extraneous matter. A socket-wheel is fixed directly under the cap to the cylinder, having a socket through which the axis passes, four spokes, and a rim. This serves as a bearing for both the axis and the cylinder, permitting them to revolve freely in contrary directions. At the bottom of the cylinder is fixed a cover, formed in part like the socket-wheel, but the spaces between the spokes are closed. In each of these compartments a large aperture is made for the egress of the grain, the rapidity of its exit being regulated at pleasure by sliding doors. As the grain enters at the top, motion is communicated to the cylinder and axis; by suitable gearing, the cylinder is made to revolve with a slow motion in one direction, and the axis, with a very quick motion, in a contrary direction. The action of the angular bars causes great friction among the grains, and, consequently, the husk is *rubbed* off before passing out of the lower end of the cylinder. It has been suggested that a blast cylinder or winnow, receiving motion by a band round the main cylinder, might be placed in such a situation as to free, by its action, the rice from the chaff as it is discharged from the cylinder at bottom. This machine does not make any farther provision for divesting the seed from its pellicle; if this, too, is rubbed off in the cylinder, its use would indeed greatly simplify the process of cleansing rice.

The apparatus employed for husking the paddy as imported into this country, is altogether under a different arrangement. This invention is due to Messrs. Lucas and Ewbank, who obtained a patent for its exclusive use in the year 1827.

By this method, the paddy is first passed over a screen which

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detains the rice, and allows any adventitious substance to pass through. In this state it is taken to mill-stones placed at such a distance from each other as to rub off the husks without breaking the grain. The chaff is next blown off by a fanning machine. The pellicle, however, still adheres to the seed, to divest it of which it is triturated in mortars. It was found by observation, that this under-skin is of a glutinous nature, so that the beating and triturating it in mortars occasioned the mass to become very sticky, and difficult to operate upon towards the close of the process, and that the grains which had already been divested of their pellicle, were injured in colour by continued contact with the others under process.

To obviate these evils, two or more sets of mortars are now used in conducting this operation. When the glutinous matter begins to act by disposing the grains to adhere together, and to move sluggishly under the stroke of the pestle, the rice is removed from the first set of mortars to the second, wherein is mixed with the grain a quantity of well dried husks, in the proportion of one-fourth or two-fifths in bulk to that of the rice. The triturating and beating process is then renewed upon this mixture, the dry husks materially assisting in whitening and cleansing the grain. After this the refuse is separated by fanning and screening. If the rice is not yet perfectly cleansed, it is again subjected to trituration, fanning, and screening, and so on, until it is entirely divested of its pellicle and is perfectly clean and white. The screen used is "sloping and revolving," and composed of three distinct wire cloths of different degrees of fineness. The finest under-cloth allows the dust or flour to pass through but detains the broken rice; the second or middle-cloth, separates the broken and detains the whole rice; while the coarsest upper-cloth allows only the whole rice or husked grain to pass through and detains the unhusked, which is taken back to the mill-stones to be operated upon again. The rice, divested of its husk and pellicle, is now taken to a polishing machine, which consists of two cylinders placed concentrically, the interior one covered with sheep-skins with the wool on,

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stretched on boards or other suitable framing, and having the wool on the outside. The outer cylinder is stationary, while the inner one is made to revolve. Between these two cylinders the rice is put, and motion is given to the interior one by the action of a steam-engine or other prime mover. The rice is thus brushed by the constant friction of the wool, and thereby polished and whitened, giving to the grain a much more handsome appearance than that which is brought ready cleansed from India.

Rice, under most circumstances, is considered a very advantageous crop. In some countries and situations it is much more productive than in others, while the respective varieties differ in their prolific properties, the finer kinds always yield less than the coarser, and indeed so great a difference is there in the return of rice crops, of good or bad quality, that he who cultivates the better sorts rarely tastes them, and is content to raise an inferior rice which forms the sole sustenance of himself and family. In Hindostan it is very often the practice for the peasants to pay the rent of their rice-ground with the half of the produce, the other half, after deducting the expenses of cultivation, &c., rarely leaves them sufficient surplus for a bare maintenance on the coarsest food.*

In Bengal, the rice-crop is generally more productive than in other parts of India, much more so than in Nepal; where the average is considered by Hamilton to be about twenty-eight bushels per acre. A good crop in Bengal, is stated to be about forty bushels per acre.

In Java, an English acre of good land yields annually, besides a green crop, 641 pounds avoirdupois, of clean-grained rice. In sandy soils on which two crops are reaped in the year, an acre yields 285 pounds per crop.†

* Tennant's Indian Recreations.

† Crawfurd.

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In the rich plains of Lombardy, the annual average crop per acre is estimated at forty-eight bushels.

In the Carnatic, where four crops are raised in one year—two on the same ground; the first crop produces fifty-fold, the second forty-fold, the third the same, and the fourth between twenty and thirty-fold. At Java, under favourable circumstances, common rice yields from twenty-five to thirty-fold. Of the mountain-rice, fifteen-fold is considered as a good return.*

It is foreign to the plan of the present work to enter into any discussion as to the relative nutritious properties of rice, as compared with other grain or with various substantive vegetable articles of food. It may, however, be remarked that the races which are sustained entirely with it, are not in general so robust and hardy as those who feed on other kinds of the cerealia.

The farina of rice, is almost entirely composed of starch, having little or no gluten, and being without any ready formed saccharine matter.

The Chinese, however, it is said, contrive to produce from it a kind of wine very much resembling sherry in colour and flavour; and in some parts of India, rice forms the chief of the materials, whence the spirit known by the name of arrack, is distilled. The proportions used and the manner of preparation, as practised in Batavia, are as follow:

Molasses,	62 parts
Toddy† or palm wine,	3 do.
Rice,	35 do.
	100 which yield 23½ parts proof arrack.

The rice is first boiled, and after cooling, yeast is added; it is then pressed into baskets and placed over tubs for eight days, during which time liquor flows from it. This liquor is then mixed with the molasses and palm wine, previously combined. In this state the whole remains for one day in a

* Heyne.

† A purer arrack is drawn from toddy alone — the manner of procuring which will be shown when treating of the cocoa-nut tree and its products.

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small vessel, and is then removed into large fermenting vats for a week, at the end of which time it is usually in a fit state for distillation.

Quantities of Rice imported into England in the Years 1829 and 1830.

	1829.		1830.	
	Shelled.	In the husk.	Shelled.	In the husk.
	cwts.	bushels.	cwt.	bushels.
East Indies.....	156,302	61,835	108,466	21,756
Sumatra and Java....	208	....	14,478	
Philippine Islands	2,096	....	2,506	
United States of America	29,430	231,066	6,147	
Brazil	738	....	256	
Africa.....	....	405	657	
Total....	188,774	293,306	132,510	21,756
Retained for home consumption....	116,854	222,472	153,652	* nil.

Price of Rice at the present time (Nov. 1832) exclusive of duty.

	Per Cwt.			
	s.	d.	s.	d.
Bengal.....14	6	to	17	6
Patna 20	0	..	24	0
Java 12	0	..	14	0
Brazil 14	0	..	16	0
Carolina 22	0	..	24	0

Duty 1s. per cwt. for that coming from British Possessions, for other sorts, 15s. per cwt. Price of Paddee, 2s. 6d. per bushel, Duty 1d. per quarter.

* The export having exceeded the quantity charged with the duty within the year.

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MAIZE.

Zea Mays, belonging to the class and order *Monœcia Triandria*. Natural order, *Gramineæ*.

MANY plants, now largely cultivated and completely naturalized in America, have, notwithstanding, had their introduction traced to the early discoverers of the Western hemisphere; while it has been made a subject of controversy, whether many others were really native productions of the soil, or whether they were originally transplanted. There is no doubt, however, in the present case — maize is certainly indigenous to America, since the natives were found engaged in its cultivation by the Europeans on their first landing. From this circumstance it took its name of Indian corn. In all other countries, except England and America, it goes by the name of maize or maise, or by some name other than Indian corn. In America its distinctive name Indian is dropped, and it is simply called corn, which word is never applied to any other of the cereal grains, such as wheat or barley, those being designated by the general name of grain.

The French frequently distinguish one variety of maize as *blé de Turquie*, thus, as it would seem, indicating the source whence this was obtained. It is supposed, that the grain so designated was introduced into France from Turkey in Asia. The cultivation of Indian corn is, perhaps, coeval with that of other grains. As we have no certain accounts when it was first introduced into Africa or Asia, it may reasonably be considered to be indigenous to these parts of the world, as well

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MAIZE, OR INDIAN CORN—(ZEA MAYS).

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as to the Western hemisphere. It is well known that this grain is cultivated as a principal crop in Egypt; and in some parts of Africa its consumption is to an extent almost equal to that of rice. It is grown in Java and the other Indian islands, though considered there inferior to rice; but it is very little cultivated in Hindostan, less than in most other countries where it is acclimatized. Humboldt considers this plant indigenous to America alone; but many other authorities who have had opportunities of enquiring into its cultivation in the East, are of a contrary opinion. A recital of the proofs brought forward in support of either side, would possess little interest, while it would be found of but trifling utility in a work of this description.

Maize constitutes the substantive article of food among the Mexicans, and is the cereal plant principally grown in the United States, where it is the favourite nourishment of both men and animals.

Maize, or Indian corn, is an annual plant. Its principal characteristics are, a jointed stalk, with large alternate leaves, almost like flags, coming forth from every joint. The male and female flowers are situated remote from each other on the same plant. The stalk is surmounted with a loose bunch or spike of male flowers of various colours, having oblong, oval, chaffy empalements opening with two valves, each inclosing two flowers; this pannicle is usually called the *tassel* of the plant. The female flowers, which are situated below the male, are disposed in thick spikes; these flowers have, likewise, thick chaffy empalements, with two valves, and are themselves composed of two short, membranaceous, broad valves. One or more of these spikes are borne on the same plant—seldom so few as one, and not often more than four or five—as many as seven have been occasionally found growing on one stalk, but it is very rare indeed to see such a number arrive at maturity. These spikes or ears issue from the plant at various distances from the root; they are closely embraced by several thin leaves, nine or often

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twelve to each ear, forming a sheath ; this is called the husk. The ear consists of a cylindrical substance of the nature of pith, this is called the cobb, from the centre of which issue radial stems ; to these are attached the germs or eyes of the seed, and very thin delicate husks united to each other in pairs, in which the seeds are securely embedded in separate compartments. These grains are usually arranged in twelve rows, each row having generally as many as thirty or more seeds. When the grains begin to be formed, there comes from each a little delicate filament resembling a single string of raw silk, except that it is of a pale and shining green. The whole of these threads come out at the point of the husk, forming a thick cluster; in this state they are called the *silk* of the plant. The farina from the male plant falls upon this silk and by this means the grain is fecundated. This is a fact well established by experiment. If the top be cut off previously to the developement of the flowers, or if the ears be deprived of their silk, they invariably prove barren. As soon as the flowers have performed their office, the tassel and silk gradually wither. The seeds are most generally white or yellow, but they are sometimes red, while others put on a blue, a green, or an olive-coloured hue. And even in the same ear may be found seeds of different colours.

Miller reckons three species of this plant; Linnæus only one. There are, however, almost endless varieties. A writer who has turned his attention much to this subject says "they are as numerous as the sorts of wheat, of which we know thirty or forty in number."* The first principal distinctions are white and yellow — early and late—and of each of these are many varieties, which have arisen out of differences in soil, climate, and mode of culture. Some of the varieties do not suffer from cold until the mean temperature falls below 45° Fahr.; and no degree of heat is injurious to it.

The largest known variety of maize is distinguised as *Zea Americana*. It is found of spontaneous growth in the central parts of America, as well as in many of the West India islands.

* Cobbett on Indian Corn.

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Under favourable circumstances it attains to a considerable height — from seven to ten feet. It has been known in some cases to have increased to the height of fourteen feet, and this without injury to its productive powers. The spike or ear of this is proportionally large, being eight or ten inches in length, and five or six inches in circumference. This variety requires rather a warm climate to bring it to maturity: it will rarely perfect itself in the more nothern regions, and could seldom be reckoned upon as a certain crop in any part of Europe. In nearly the whole of Mexico it can be successfully cultivated. Its growth is naturally more luxuriant in the lower districts than in the more elevated or table land *(tierra caliente.)* But even when under cultivation at an elevation of six or seven hundred feet above the level of the sea, its productiveness is so great as scarcely to be credible by those who are only familiar with the returns of European agriculture. It has been known in some situations to increase eight-hundred-fold, and in spots which are artificially irrigated, it commonly yields an increase of from three hundred and fifty to four hundred. In other places where the moisture is only supplied by rain, and even in the least fertile spots, the returns are rarely less than from forty to fifty bushels for one sown. This large return is made without the aid of manure in Mexico. From the middle of June to the end of August is the period usually devoted to the sowing of maize in that country. The seed is sown in rows sufficiently far apart to admit of a small plough going between, in order to loosen the soil and destroy the weeds. Two or three grains are deposited together in holes three feet apart. In certain situations in Mexico three crops of maize are annually produced, but this is only in warm and humid places under very favourable circumstances; in other parts one harvest only is obtained.

Nearly the same mode of culture is pursued in the United States of America, except that artificial irrigation is not practised. The plant is not found so productive there, although the system of manuring is universally followed. Compared however with the produce obtained from the other

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grains, this is by far the most prolific. In Pennsylvania the average crop of wheat is rarely more than from fourteen to seventeen bushels per acre, while that of maize amounts to twenty or thirty bushels on the same space of ground.

White-grained-Maize, or *Zea alba* — is a smaller plant than the *Zea Americana*, rarely attaining to eight feet in height. The top droops, and the leaves are narrower. The ears are about six or seven inches long. This is the *blé de Turquie* of the French, in whose country it is partially cultivated, and likewise in Spain, Portugal, and Lombardy. It rarely succeeds in England, and is only cultivated as a curiosity in a warm border. The *Zea vulgaris* is of smaller growth than the *Zea alba*, not often attaining to a greater height than four feet. The spikes are about four or five inches in length. This variety is hardier than the others, and comes to maturity in ordinary seasons in England. In situations where no particular care has been taken of its culture, it has yielded more than a hundred-fold. The brief period of its vegetation from sowing until it perfects its seeds, causes it to escape the risk arising from the late frosts in spring, and the early frosts in autumn. The seeds of this variety, are both yellow and white. It originated in North America, in some parts of which it is cultivated with success; and it grows likewise in some of the middle countries of Europe.

Maize may be successfully grown on much poorer soil than would produce a profitable crop of wheat, or even of barley, oats, or rye. Cobbett remarks, "I have seen it grown in America, in fields which would have borne neither of these, and this in thousands and thousands of instances. It is regarded as what we call *a fallow crop*, as well as a productive crop. I have seen fields which have lain for several years without producing any thing but a little miserable grass, liberally mixed with red sorrel and other weeds, which will live when all other plants will perish." . . . "I repeat, that any land which will bear a crop of grain of any sort, even an inferior crop of grain, may be made to carry a tolerably good crop of Indian corn."*

* Cap. iii. par. 34.

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Though a poor land may be advantageously turned to this cultivation, it will not succeed in a stiff, clayey soil. There is not much trouble taken in the preparation of the ground. As soon as the frosts of spring are over, it receives a shallow ploughing. In Pennsylvania and Long Island, this usually takes place in March. It is left in this state until the beginning of May, when it is harrowed, but so superficially, as not to bring up the sward which the plough had covered over. The harrowing is repeated very often, until the surface of the ground is thoroughly broken and very fine. This work is usually performed by one horse, which is guided by a boy sitting on its back — sometimes a yoke of oxen is substituted. In the middle of May, the seed is consigned to the earth. The Indians, before being visited by the Europeans, used to have a natural calendar, whereby the periods most fitted for sowing their seeds were regulated. The budding of a certain species of tree, and the visits of a certain fish to their waters, were unerring indications of the arrival of the most favourable time for maize sowing.

In the middle of May, then, the ground is marked out for sowing the seed. This is done at regular intervals, in clumps, which are called hills, since, by subsequent culture, they become raised into the form of hills before the end of summer. This operation is usually entrusted to a boy, who is, for that purpose, mounted on a horse having trace harness — the traces being well suspended by means of hip-straps, and kept asunder by a short spreader behind. These traces are hooked on to a smooth and heavy log, rounded at the end nearest to the horse, and about eight or ten feet in length; this is drawn along the field in parallel paths in the direction of the straightest side, and at intervals of four feet apart. In the same manner, and at the same distances, marks are made with the log at right-angles to the others — thus dividing the whole field into squares.

About half a shovel full of well rotted and finely broken manure is then laid at every point of intersection. This work is done by a man, or boy, driving a waggon loaded with manure, from which he tosses down the due quantity at the

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proper places, with great expedition and exactness. The sowing of the corn is the next operation. The manure having been put into a level form by means of a hoe, four or five seeds are thrown upon it, and a little fresh earth is gathered from around to cover them about an inch deep, this is pressed down on the seeds with the foot, which completes the work of sowing. Very large returns cannot be expected from soil and preparation like this, but if the after-cultivation be carefully pursued, a very tolerable crop is generally gathered in. It is requisite to the thriving of the plants, that the soil should be thoroughly stirred, and that very near to them while they are growing. By this means, fresh portions of the soil are brought in contact with the fibres of the roots, and thus new nutriment is provided for the plant.

There is no doubt as to the practical good effects of this system. "You will see in America a field of corn, late in June perhaps, which has not been ploughed, looking to day sickly and yellow. Look at it in only four days' time, if ploughed the day after you saw it, and its colour is totally changed."

It is not usual to transplant maize in the manner practised in rice cultivation, but it is thought that this method might be practised with advantage. The plant bears moving extremely well, and it is considered that this kind of treatment might be cheaper than the common way of culture, since it would yield a more productive and earlier harvest. When the plants are only about five or six inches high is the most favourable time for removing them, but even when two feet and a half high they have been transplanted with success.

As soon as they are taken from the seed-bed, they should be planted at regular intervals with a dibble, in newly ploughed ground, and when the weather is dry. The plants should be taken out of the seed-bed with as little injury to their roots as possible, and the mould should not be shaken from them. A well practised hand might plant an acre a day.

Weeding is very necessary from the earliest growth of this corn, besides which, the frequently moving the earth round the plants, as has been already observed, greatly assists its

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growth. This work should be done with a hand-hoe when the plants are about three or four inches high. A diligent workman can thus weed about two acres a day. Soon after this turning up of the ground, another abundant crop of weeds arises: then the ploughing between the plants must be pursued, sending the share very near to the plants, and at least six or seven inches deep. If the ground be not very foul, one more ploughing is sufficient. The time for conducting this, is according to the height and state of the plant. When the panicle of male flowers, or tassel, begins to show itself above the axillæ of the upper leaves, is the most favourable period for the second ploughing: this time the plough must not be driven quite so near to the plants as before. It might be supposed that the plough would injure the roots in tearing away part of their fibres at this advanced stage of their growth, but the contrary is the fact — the plants being benefited by the practice; as all the lateral roots of the plants are torn to pieces or cut off, the remaining parts of these roots gain fresh vigour and become greater feeders than the whole of the roots were before.

Besides the one principal stalk, each root sends up two, three, four, or more suckers. If these be left to grow, they likewise will bear ears; but they are almost always very small, and do not ripen so soon as the ears on the main stalk, while if allowed to remain, they necessarily deduct from the size and goodness of the principal ears. It is therefore the practice to detach these suckers from the root as soon as they are three or four inches long. "The suckering," says Cobbett, in his characteristic manner, "should be performed by a trusty person who has strong fingers, and who is not too delicate to poke those fingers down into the dirt a little, for unless you get the suckers completely out from the socket they are sure to start again." After the suckers are removed, the plants are earthed up, which work is performed with a large hoe, earth being drawn round the stalks to the height of six or seven inches.

The earthing up is productive of two advantages: first it supports the plant in an erect position, when exposed to high winds; without this assistance, the stalks are too strong to

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be ever laid; but it is desirable that they should not have even any inclination on either side. The principal use, however, of this practice, is to give to the plant a fresh stock of roots; for this, like many other plants, sends out new roots from the part of the stalk covered up.

When the male flowers have performed their office, the top and the leaves of the plant are taken off: the ears coming to maturity earlier in consequence of the more free exposure to the sun and wind. The proper time for this operation of course depends more upon the advanced state of the plant than upon any definite period of the season.

When upon examination, the grains are found to be tolerably hard, not sufficiently so for grinding, but hard enough to resist the pressure of the thumb-nail — when the tassel is divested of all its farina, and becomes withered and dry — when the ends of the silk lose their verdure, and assume a dead appearance — these are unfailing indications that the work of topping should commence. It is not of very difficult performance. The top and the upper leaves are cut off with a sharp knife; the other leaves are stripped close to the stem. These are laid down in small heaps as they are plucked. They remain in this situation till the leaves are well dried, which will be at the end of two or three days, if the weather be fair: they are tied in little bundles or sheaves, the tops being on the outside, the leaves within, because the succulent stalks of the top require more drying than the leaves. These sheaves are then set up in little shocks, and left until the whole is sufficiently dry. If well dried they prove most excellent fodder for cattle.

The American farmers apply them to this purpose during the spring of the year, before the new grass shoots up, and when their draught animals have the most laborious employments.

When the grains are become quite hard and the husks are turned white, they are in a fit state to be gathered. This period varies very much, according to the climate and variety. In tropical countries maize comes to maturity very rapidly — from two to three months after sowing. In the West India

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islands, it grows to the height of fourteen feet, and frequently completes the circle of its vegetation in forty days. In Java, maize with a smaller grain ripens in five months, and the larger grain in seven. The ears are stripped off the stem with their foot-stalks attached to them. From the field they are conveyed at once to the barn. It is immaterial when they are divested of their husks, as they may be kept hanging from their stalks without the least injury accruing. The husking may, therefore, be an occupation for leisure hours, and it is a work which can equally well be performed by children. The corn, when husked, should be preserved in little granaries or bins, standing upon stones. The ends and sides of these bins are not boarded, but merely lathed, leaving interstices too small to allow the passing through and falling out of the ears of corn. If they were to be kept together, and excluded from the air, the moisture of the cobbs would not have vent for evaporation, and they would soon become mouldy and spoil. The corn can thus be preserved for a great length of time, and is either sent to market in this state, or taken from the cobb. When in single grains it is distinguished as shelled corn. The native Indians preserve their corn in a different, but not less efficient manner. When gathered, the grains are immediately stripped from the cobb, or else the ears are hung up, tied at regular distances from one another—if laid near together they will sprout or heat and rot—but if kept cool and separate, they will remain good all the winter. The best method, however, which the most careful among the cultivators pursue, is to thresh out the corn as soon as the harvest is over, to dry it well on mats in the sun, and then to lay it up in deep holes made in the earth: these subterraneous granaries are well lined with mats, and after being filled with the grains are covered at top with more earth. This mode always preserves the corn in a good state.

Sometimes the grain is taken from the cobb in America, by spreading the ears six inches deep on a barn floor, and then subjecting them to be trampled upon by horses or oxen; but this is a slovenly and wasteful method, and only the indolent and bad managers have recourse to such an expedient. When

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there are but few hands for the work, this corn is threshed out in the same manner as other grain; but the plan is very seldom pursued, as it is attended with some waste. An American husbandman will in this way knock out a hundred bushels of shelled corn in the course of the day. The more usual mode is to fix a piece of iron, with rather a sharp edge, over a broad tub; an ear of corn is then taken in both hands and scraped longitudinally across this piece of iron; the grains fall into the tub, and the cob is then thrown aside. In this manner a diligent and strong workman will shell from twenty to thirty bushels a day. A few years ago a machine was invented in America for shelling corn, and this will, no doubt, supersede all methods in which unassisted manual labour only is employed. The ears are put into a hopper, and by means of a wheel turned by one man, the shelled grain comes out at one part, and the bare cobb at another. This expedites the business, and lessens the labour much.

The cobbs, when dry, make excellent fuel, to which purpose they are most generally applied.

The stalks, which are left standing on the ground, make good fodder for cattle. These are generally left till November before being cut down. The whole plant abounds with so much saccharine matter, that there is nourishment in every part.

The stalk, while growing, is very soft and juicy; and from this juice a syrup, as sweet as that of sugar, has often been obtained.

The husks are used to stuff bedding in America, and are found better for this use than hay or straw, because much softer. They are tough, and their texture is nearly as fine as that of any silk; they are, therefore, excellently well adapted to the purpose, being fine, elastic, and very durable, never crumbling into dust like hay or straw.

Maize, at the beginning of its growth, is liable to the attacks of birds and slugs; precaution should, therefore, be taken against these until the plants are about three inches high, when they are safe from such attacks.

For about a fortnight only it is necessary to keep vigilant

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guard, in order to scare away or shoot the winged depredators, to which, after that time, the plants are no longer a delicacy. The most effectual remedy for the destruction of slugs is quick-lime. This, pulverized very finely, and shaken over the young plants just after sunset, will secure them from the slugs, provided the work be persisted in for several days as soon as the corn appears above ground.

This grain is not subject to blight, mildew or rust, and is never liable to be beaten down by rain. On land which has been properly ploughed and prepared, the returns are always much greater than those from any other kind of grain;* and taking into consideration the greater size of this seed, the greater produce from one stalk is remarkable. From one single stalk on a farm in Bedford, seven ears of corn have been gathered, the whole together containing 2,077 grains; and it is not uncommon to meet with ears, each of which contains from five hundred to six hundred grains.

Two bushels of ears yield one bushel of shelled corn: this proportion is so constant, that in the American market, two bushels of the one are always considered equivalent to one of the other, and are received as such without question by the purchaser.

It has been found, from chemical analysis, that maize contains a very small proportion of gluten, and but very little ready-formed saccharine matter; whence the inference has been drawn, that it is defective in nutritive qualities; but facts are in direct contradiction to this assumption. In countries where maize forms the substantive article of food among the lower orders, these are usually strong and robust. Horses thrive on this substance when in full work; all domestic animals become fat on this diet, and their flesh, at the same time, firm. The use of maize, as the principal corn among the inhabitants of North America, is so universal, that the untravelled and unlettered among them can scarcely be made to believe that there exists any people who do not make use of

* In the province of Kăder in Java, four or five hundred-fold is not an unfrequent return — one hundred is a fair average on the poorest lands, and with the most indifferent culture. — Crawfurd.

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Indian corn as part of their nourishment.* Its application to this purpose in England, either as an importation from

* The importance of this cultivation, and the variety of purposes to which the corn is applied, cannot be better set forth than in the words of Dr. Franklin. "It is remarked in North America, that the English farmers, when they first arrive there, finding a soil and climate proper for the husbandry they have been accustomed to, and particularly suitable for raising wheat, they despise and neglect the culture of Indian corn or maize; but observing the advantage it affords their neighbours, the older inhabitants, they by degrees get more and more into the practice of raising it; and the face of the country shows from time to time, that the culture of that grain goes on visibly augmenting.

The inducements are the many different ways in which it may be prepared so as to afford a wholesome and pleasing nourishment to men and other animals. First, the family can begin to make use of it before the time of full harvest; for the tender green ears stripped of their leaves, and roasted by a quick fire till the grain is brown, and eaten with a little salt or butter are a delicacy. Secondly, when the grain is riper and harder, the grain boiled in their leaves and eaten with butter, are also good and agreeable food. The tender green grains dried may be kept all the year and mixed with green *haricots* (kidney beans) also dried, make at any time a pleasing dish, being first soaked some hours in water, and then boiled. When the grain is ripe and hard, there are also several ways of using it. One is to soak it all night in a *lessive* or lye, and then pound it in a large wooden mortar with a wooden pestle; the skin of each grain is by that means skinned off, and the farinaceous part left whole, which being boiled, swells into a white soft pulp, and eaten with wilk, or with butter and sugar, is delicious. The dry grain is also sometimes ground loosely, so as to be broken into pieces of the size of rice, and being winnowed to separate the bran, it is then boiled and eaten with turkeys or other fowl, as rice. Ground into a finer meal, they make of it, by boiling, a hasty pudding or *bouilli*, to be eaten with milk or with butter and sugar; this resembles what the Italians call *polenta*. They make of the same meal with water and salt, a hasty cake, which being stuck against a hoe or other flat iron, is placed erect before the fire, and so baked, to be used as bread. Broth is also agreeably thickened with the same meal. They also parch it in this manner. An iron pot is filled with sand and set on the fire till the sand is very hot. Two or three pounds of the grain are then thrown in and well mixed with the sand by stirring. Each grain bursts and throws out a white substance of twice its bigness. The sand is separated by a wire sieve, and returned into the pot to be again heated and repeat the operation with fresh grain. That which is parched is pounded to a powder in mortars. This being sifted will keep long for use. An Indian will travel far and subsist long on a small bag of it, taking only six or eight ounces of it per day, mixed with water. The flower of maize, mixed with that of wheat, makes excellent bread, sweeter and more agreeable than that of wheat alone. To feed horses, it is good to soak the grain twelve hours, they mash it easier with their teeth, and it yields them more nourishment. The leaves stripped off the stalks after the grain is ripe, tied up in bundles when dry, are excellent forage for horses, cows, &c. The

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America, or as a grain of home growth, would, it is considered, be attended with great advantages.

stalks pressed like sugar cane, yield a sweet juice, which being fermented and distilled, yields an excellent spirit; boiled without fermentation it affords a pleasant syrup. In Mexico, fields are sown with it thick, that multitudes of small stalks may arise, which being cut from time to time like asparagus, are served in desserts, and thin sweet juice extracted in the mouth by chewing them. The meal wetted is excellent food for young, and the old grain for grown fowls."—Franklin's Works, vol. ii. p. 276—8, 4to. edition. 1818.

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MILLET.

Holcus Sorghum, belonging to the class and order *Polygamia Monœcia*— natural order *Gramineæ*.

Panicum Miliaceum — *Germanicum* — *Italicum*, three species of a genus belonging to the class and order *Triandria Digynia*, and natural order *Gramineæ*.

In countries where the arid soil and scorching influence of the sun are uncongenial to the production of other grain, millet can be successfully cultivated. Under such circumstances it becomes a substantive article of food, forming the chief sustenance of the people in Syria, where it has been cultivated from time immemorial; in some parts of Arabia; in the sandy districts of India, and in the more arid regions of Cochin China. Scarcely any other grain is produced in Nubia. In all the Northern provinces of China, the grain of the *holcus sorghum* is cheaper than rice, and it is probable that this was the first cereal plant cultivated among the Chinese, since its seed is used to denote their measures of capacity and length. Thus, one hundred grains will fill a *choo*, and this measure is considered the standard, and is multiplied and divided into decimal proportions for other measures. In like manner the long measure is determined. This plant is distinguished in China under the name of *Kow-Leang*, or lofty corn.

It rises there to about sixteen feet in height, and in most tropical regions usually attains to this growth.

The seed of plants of two different genera are both con-

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GREAT INDIAN MILLET—(HOLCUS SORGHUM).

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founded under the name of millet. Hence the various accounts of the height to which the millet-bearing plant attains, when, in fact, those plants, which rise to the greater height described, are altogether different from those which are of more humble growth. Both *holcus sorghum* and *panicum miliaceum*, are cultivated in Asia and Africa, and in some cases they are under culture at the same time, in the same field. In China the two are sown in alternate ridges. The more humble *panicum* is concealed by its stately neighbour, with the reaping of which it interferes but little; after that is cut down, it raises its head under the influence of the sun, and soon comes to maturity.

Great Indian millet, or *holcus sorghum*, is, perhaps, more universally grown in the tropical regions, where it is designated by many different names, proving that it is indigenous in most of the countries, where it is at present under cultivation. In the various districts of India it is known by a name peculiar to each locality. In Egypt and Nubia it is called dhourra; Guinea corn is the appellation by which it is most familiarly known in the West Indies, and it is supposed by some writers to have derived this name because originally brought from the Western coast of Africa, or, according to others, because it forms so large a proportion of the food of the negro population.

This is an annual plant, which rises with a strong jointed reed-like stalk, attaining from ten to twenty feet in height, having, at each of the joints, a leaf embracing the stalk with its base. These leaves are about thirty inches long, and two inches broad, having a deep furrow through the centre of the upper surface, where the mid-rib is depressed, and is very prominent in the under part. The stalk is terminated by a large upright oval panicle, but this, as it ripens, droops, and becomes then somewhat similar in appearance to the male spike of Indian corn. The calyx is green and pubescent; the awn brown at bottom, smooth and whitish at top. The seeds are spherical, sometimes of a red, and sometimes of a milky white colour, with a black dot. They are enclosed in husks, and are farther protected by their long awns or bristles,

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which guard them from the attacks of birds better than any other kinds of grain are protected.*

Common millet, *panicum miliaceum*, rises with a channelled-jointed stalk from three to four feet high. At every joint there is one reed-like leaf, having attached to its base a sheath which envelopes the joint of the stalk below the leaf, and is clothed with soft hairs, which, however, do not extend to the leaf. This has several small longitudinal furrows, running parallel to the mid-rib. The stalk is terminated by a large loose panicle hanging on one side. It is an annual plant, native of Asia and Africa, but it has been acclimatised to the South of Europe, where it is cultivated for the sake of its grain. There are several varieties distinguished by the colour of their seed.

The grains of common millet are extremely small, but the number growing on each stalk is so very great, that the aggregate produce places it on an equality with the crop obtained from any of the other cereal plants. Hence it obtains for one of its names *milium*, from mille, a thousand.

Two other species of *panicum* are likewise cultivated for their seed. These are, German millet, *panicum Germanicum*, and Italian millet, *panicum Italicum*. The first of these varieties attains to the height of three or four feet, having, at each joint, a leaf about a foot and a half long and an inch broad at the broadest part, terminated by a compact spike about eight or nine inches in length, and three inches thick at the base, tapering towards the end. This is closely set with small round grains, which so readily separate from the husk, that, when arrived at maturity, they are liable to be shaken out. It is an annual plant, and dies soon after the seeds come to maturity. These grains are rarely used for human food; their principal application is to the feeding of poultry. There are three varieties of this species, distinguished by white, yellow, and purple grains.

This plant is considered to be indigenous to the north of Europe; but it is more than probable that it is originally from India, and has become, in a long course of years, accli-

* Brown's Jamaica.

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COMMON MILLET—(PANICUM MILIACEUM).

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matized in Germany. The seeds from the former country do not fructify when first cultivated in the colder climate. This, however, furnishes no proof that what has been stated is not the case; since it is a fact well ascertained by experience, that the habits of plants may be gradually changed, and may become accommodated to other climates.

Italian millet, *panicum Italicum*, is very much, in all its characteristics, like the German species, but it is a larger plant altogether. Its reed-like stalk rises to nearly four feet high, and it is much thicker than the preceding. The leaves are broader, and the spike, about a foot long, is also twice the thickness. This is not, however, so compact, being composed of several roundish clustered spikes, bearing much larger grains. There are two or three varieties of this species, also differing in the colour of the seeds.

This species is a native of both the Indies and of Cochin China, but it is frequently cultivated in Italy: hence its trivial name. It is grown in Tuscany for the purpose of feeding poultry, horses, and other domestic animals. The leaves and straw likewise furnish food for cattle.

Brushes are sometimes made of the culm, and not unfrequently the grain forms the material of a coarse, dark-coloured bread, which is eaten by the lower classes in Italy.

A light, soft, sandy soil is favourable to the growth of all the different kinds of millet, and the same method of cultivation is pursued with each. The *holcus sorghum* being a larger plant, the seed is sown thinner than that of the *panicum*.

It is not only the seeds of the millet which are applied to useful purposes as a substantive article of human food in many countries, but the leaves and stalks are likewise converted to economical service. In China, the thick culm, or stalk, of the great Indian millet is woven into mats, and the lower part of the stalks, together with the root, serves for fuel. The leaves and stalks are, in general, considered valuable fodder for animals, in situations where any other could with difficulty be procured. Heyne remarks, in one of his journies in Hindostan, "The millet is now ripe, and affords an excellent provender for our camels, elephants, and bullocks. I had frequently regretted

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that so much of the ground was occupied by a small-eared pitiful grain, but the vast quantity of straw, about ten feet long and an inch of circumference, makes a fair compensation for the meanness of the ear."

In warm climates, millet is sown in June, and usually comes to maturity at the end of four months. This crop is of easy cultivation; the principal care of the husbandman is to leave sufficiently large intervals between the plants to allow of their freely tillering. Two ploughings are given to the ground; with the last, shallow furrows are made, in which the millet-seed is thinly scattered, and then immediately covered with earth. When the soil on which it is to be sown, is of a very dry nature, some cultivators pursue rather a different practice.* They consider it better to put in the seed in the evening, and leave it uncovered during the night, that it may profit by the falling dew; it is covered with earth the next morning by means of a harrow, and afterwards a roller is passed over to press in the seed. If sowed early, in a more temperate region, the crop is very liable to be entirely destroyed by the slightest frost of spring. A month after the plants have risen, they are hoed and thinned, an interval of seven or eight inches being left between the plants with the *panicum*, and much greater distances between those of the *holcus sorghum*. It is only requisite to keep the plants free from weeds during the early part of their growth since, their own abundant vegetation will soon spread and shoot up, so as entirely to occupy and shade the ground, and prevent the intrusion of weeds.

The *holcus sorghum* is not so liable to the attacks of birds as the *panicum;* this latter is sometimes, notwithstanding the greatest precautions are taken, very much injured by the persevering attacks of these winged assailants. Andanson describes the precautions taken by the natives of Senegal to preserve their millet from such depredations. "The grain," says he "was then at its maturity, and attracted an infinite multitude of birds, which made considerable ravages. To scare them away, the inhabitants had crossed their fields with a great number of strings, to which were suspended shells,

* Du Hamel.

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bones, and other similar bodies capable of making a noise by being struck one against the other. Four cords, which gave movement to the whole, were attached to these at the four corners of the field, where women and children, stationed under covered platforms seven or eight feet high, kept guard, and on the approach of the birds put all in motion, by pulling the cords; to the noise they thus produced, they added the music of their own voices, creating a din sufficient, it might have been supposed, to frighten away the stoutest biped: however, notwithstanding the noise persisted in, and the vigilance exercised, the birds committed great depredations."

When the crop is ready for harvest, the ears are cut off near to the top of the culm. These are conveyed to the barn in sacks or baskets, laid up in heaps, and covered for a few days. After that period, they are spread on the barn floor, threshed with a flail like other corn, and then winnowed. In some parts of India, the more ancient method, that of treading it out by oxen, is still pursued.

If the millet be thoroughly dry before it is laid up in the granary, it will keep longer and better than any other grain; but if it be not perfectly dry, it will soon be spoiled. The weevil does not infest this corn, nor is it necessary to turn it over so frequently as is required with other grain. The advantages attendant on the cultivation of millet are, its adaptation to all descriptions of soils; the small quantity of manure which is necessary for the land on which it is grown, the trifling amount of labour required for its production, and the small degree of exhaustion, compared to the abundant return which it yields.

Some experiments were made about the middle of the last century, by M. Tschiffeli, who at that time introduced millet into cultivation in Switzerland. According to these, the produce of this plant is indeed surprising.

M. Tschiffeli received a small quantity of seed (not more than could be held in a tea-spoon) from Dr. Schreber; this he sowed in the month of May, in a gravelly soil, exposed to the north wind, and which, the preceding year, had produced a very poor crop of bigg. The seeds were spread

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very thin, and they sprung up in luxuriant vegetation; the stalks rose to the height of eight feet and upwards, and the ears were above ten inches long. Unfortunately, a shower of hail destroyed half the plants, or the spoonful would probably have multiplied into a peck. In the same month of the ensuing year, a quart of this seed was sown in a piece of ground about twenty paces long and half as broad. It was soon found, however, that this space was too circumscribed for the quantity of seed; this was shown by the the stalks coming up so close as to interlace with each other. Thus impeded in growth, they scarcely attained to the height of five feet, and their panicles were not nearly so large as those of the preceding year. The produce, however, was seven pecks, or fifty-six fold. In the next year, a half-peck was sown on thirty square rods of land. This was likewise found to be too thick; the still greater tillering causing the ground to be crowded nearly as much as in the preceding year. The produce was, however, very great, being twenty bushels, a return of one hundred and sixty for one, and at the rate of more than one hundred bushels for the acre.

From this experience, M. Tschiffeli considered that ten pounds of seed would be amply sufficient for one acre of ground; and that, in such case, the consequent greater tillering of the plants would produce a still greater proportion between the seed used and the quantity of grain harvested.

In England, the autumn is not usually sufficiently dry for ripening millet, or it might prove a profitable crop on poor and sandy land.

Soil, climate, season, and manner of planting, of course have a material influence on the produce obtained; in climates favourable to its growth, large returns are obtained from its cultivation.

The golden-coloured millet seed, which is occasionally used as a material for puddings in this country, and which is found for sale in the grocers' shops, is the seed of the *holcus sorghum saccharatus*. This variety is indigenous to India; it is cultivated largely in China and Cochin China, and it has likewise been introduced into Jamaica.

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SAGO.

Sago-tree—*Metroxylon Sagu.*

THE sago of commerce is the pith of a tree growing in the Eastern Archipelago, and which, until very recently, has been classed among the family of palms. Botanists now, from farther investigation, no longer rank it in this order. Its native country is that portion of the Archipelago "in which the easterly monsoon is the boisterous and rainy one."* This geographical range embraces the eastern portion of Celebes and Borneo —on the north it is bounded by the island of Mindanao; on the south, Timur; and on the east, New Guinea. It is found most abundant in those islands which are most propitious to the growth of the clove and nutmeg trees. The great island of Ceram is most distinguished for its production. It is there found in immense forests, flourishing spontaneously in an uncultivated state.

In proof that the sago-tree is indigenous to these parts of the Indian islands, and to these only, Crawfurd adduces the fact, that each tribe has its own vernacular term for it, unlike the Cerealia, distributed from one tribe to another, and known every where by a common name. Thus, in the Ternati language, the tree is called *Huda.* In Amboyna it is termed *Lapia,* and the farina *Sagu maruka* — in Bundu, *Romilio,* and the farina, *Sangyera.* In Macassar, *Rambiya,* and the farina, *Palehu* — in Mindanao, *Lăbi.* While the inhabitants of each of the islands, where it is indigenous, have their peculiar name by which they designate this tree, in other places where

* Crawfurd's Indian Archipelago.

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it has been introduced, it is known under but one and the same name. All the western tribes of the Archipelago call it *Sagu*, which is merely an abbreviated form of the Amboynese term for the farina. In Java it is not grown except as an object of curiosity.

The sago-tree—*Metroxylon Sagu—Sagus Farinifera* is of very peculiar growth; it seems intermediate between palms and ferns, having pinnated leaves with linear and acute leaflets. It is of lower growth than most of the palms, its extreme height seldom exceeding thirty feet, while its trunk is of much greater thickness than the palms usually attain, being from five to six feet in circumference. In the early period of its vegetation, the stem appears to be formed of the bases of the leaves, and the plant has all the appearance of a bush with many shoots. Until the trunk has attained the height of from five to six feet, it is covered with sharp thorns, which effectually secure it from the depredations of the wild hog, and other animals of the forest. When the wood is become sufficiently hard and mature to resist these attacks uninjured, the spines drop off. The utmost age of the tree does not exceed thirty years. It bears fruit of "an inconstant shape and size, from that of a prune to that of a pigeon's and that of a pullet's egg." * Like the palms, it can be propagated by the seed alone. This plant will not thrive in dry or mountainous situations; it is an inhabitant of only low marshy spots: a good sago plantation or forest is a bog knee-deep. Only one species of this tree is known, which divides itself into four varieties; two of these are distinguished into the cultivated and the wild; one variety is known by the length of the spines on its branches, while another is found wholly destitute of these thorny additions; this last is usually called by the natives *female* sago. The first and last afford the best farina. The pith of the second variety is hard, and the farina is extracted from it with difficulty. The stem of the third is comparatively slender, and therefore yields a much smaller quantity of farina than the other kinds. Before the tree has

* Crawfurd.

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SAGO PALM—(SAGUS FARINIFERA).

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arrived at maturity and, previous to fructification, the stem * consists of a thin hard ligneous tube, about two inches thick, filled within with an enormous volume of a spongy medullary matter or pith, like that of alder. This pith affords the edible farina, which is the *bread* of the inhabitants of the Molucca islands.

As the fruit forms, the farinaceous medullary substance disappears; and when the tree arrives at perfect maturity, the pith is wholly dissipated, leaving the stem nothing but a ligneous hollow shell. The period most proper for extracting the medullary substance depends rather on the nature of the soil on which it is grown, and its consequent degree of advancement, than upon the actual age of the tree: the average term of this may perhaps be reckoned fifteen years; the time, however, is determined from the appearance of the tree, and by an actual experiment on the pith. No particular season of the year is chosen; but the pith is taken as occasion requires, and as the individual trees become fit for the purpose.

The inhabitants of the Moluccas mark six stages in the progress to maturity of the medullary substance. The earliest indication is the appearance of a mealy efflorescence on the branches; the last is the commencement of fructification. The medulla may be extracted in any of these stages, and the natives, trusting to their experience, often proceed to cut down the trees from the appearance which they exhibit. The surest test, however, is to ascertain the state of the pith by actual experiment: this is done by boring a hole through the stem, extracting a piece of the pith, and examining its degree of matureness. When it is pronounced to have arrived at the most favourable condition, the trunk is felled down close to the root. It is then cut transversely into pieces of about six or seven feet in length; these are split into two parts, disclosing

* Exterior trunci lignum seu potius cortex durus tantum crassus est digitos—Reliqua interior pars repleta est alba humida ac fungosa medulla quam omnipotens Creator hisce indigenis concessit loco oriza seu alius frumenti ex quibus panes pinsitur uti infra iudicabitur.—Rhumphii Herbarium Amboinense, tom. i. p. 73.

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the medullary substance with which they are filled; and which is scooped out and beaten into a coarse powder resembling sawdust, by means of an instrument made of bamboo or some hard wood. In this state it is put into a trough, and mixed with water, and when in combination, the mixture is strained through a sieve fixed at one end of the trough, by which means the fibrous parts remain behind, and the water charged with the farina passes through into a second vessel, where it is left for subsidence. The farinaceous matter falls to the bottom, and the supernatant water is drawn off. It must then be subjected once or twice more to the same process; when it will be sufficiently purified and fit for use.

The mass of nutritive matter afforded by one tree is enormous; five or six hundred pounds is no unusual quantity: allowing for the perishing of some plants, and the unproductiveness of others, the average rate in a plantation might perhaps be fairly assumed at three hundred pounds per tree: if the plants be placed at a distance of ten feet from each other, an acre will contain about 435 trees; and supposing each of these to come to maturity in fifteen years, they will yield 8700lbs. annual supply of farinaceous matter.

The sago meal, in its crude state, will keep without any other preparation for a month. For farther use it is made into cakes which can be preserved for a very considerable time. These are made in moulds of earthen-ware, divided into compartments. The moulds being first heated, dry meal is thrown into them. This, in a few minutes, is formed into hard cakes, which, being removed, they are immediately replaced by other meal, so that one heating of the moulds serves to bake several series of cakes. These vary in form and size according to the country in which they are made. Those of Amboyna are about six inches long, and half as broad; while those of Ceram are much larger and excessively hard.

The cakes are exposed for sale in the markets strung on a filament of cane: the largest proportion of sago is consumed in this form. A considerable quantity is also used by the natives when made into a kind of panada, which they eat with a

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fish soup prepared for the purpose. The particular manner of concocting this favourite dish is minutely given by Rhumphius.

The sago intended for exportation is made to assume a granular form, by mixing the finest sago meal with water into a thick paste. This is then rubbed through a sieve into small grains of the size and form of coriander seeds.

Although this medullary substance forms so large a portion of the nourishment of the islanders of the Eastern Archipelago, it would appear that the preference is given to this food in consequence of the small amount of labour required to procure it; but if the obtaining of any of the cerealia were attended with as little trouble, there is no doubt the natives would gladly exchange their diet, as they are always well pleased when they have the opportunity to substitute rice for their native bread, esteeming it a sustenance much more agreeable. Forrest speaks in high praise of sago; but he is forced, in conclusion, to acknowledge that his crew, mostly consisting of Malays, preferred rice to this aliment; and when the small stock of the former, which he had on board, was nearly exhausted, he often overheard them uttering complaints, and say, "We must soon eat Papua bread."

The manner of separating the farinaceous from the fibrous matter, somewhat varies in the different islands. The process already described, is that pursued in the Moluccas. Dampier gives rather a dissimilar account of the mode practised at Mindanao. "The valleys," says he, "are there well moistened with pleasant brooks and small rivers of delicate water, and have trees of divers sorts, flourishing and green all the year. The trees, in general, are very large, and most of them are of kinds unknown to us. There is one sort which deserves particular notice, called by the natives *libby* trees. These grow wild in great groves of five or six miles long by the sides of the rivers. Of these trees sago is made, which the poor country people eat instead of bread, three or four months in the year. This tree, from its body and shape,

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is very much like the palmetto-tree or the cabbage-tree, but not so tall as the latter. The bark and wood is hard and thin, and full of white pith like the pith of an alder. This tree they cut down, and split it in the middle, and scrape out all the pith, which they beat lustily with a wooden pestle in a great mortar or trough, and then put it into a cloth or strainer held over a trough, leaving nothing in the cloth but a light sort of husk which they throw away; but that which falls into the trough settles a short time at the bottom like mud, and then they draw up the water and take up the muddy substance, wherewith they make cakes, which, being baked, proves very good bread."—Vol. i. pp. 310, 311.

The other parts of the tree are likewise applied to useful purposes. The hard wood of the stem is employed for building; and the thick ligneous stalk of the leaf, which is deeply channelled on the upper surface, is of still more general application. The leaf is employed for thatching houses, and the bran, or refuse of the pith, for feeding hogs.

This refuse matter, when thrown into heaps, putrifies, and an edible mushroom, of a very delicate quality, springs from the corruption. In the same heaps, as well as in the decayed wood, a worm of a white colour, with a brown head, is generated. The natives of the Moluccas consider this as a great delicacy; and Europeans, who have conquered their first disgust to such a species of dainty, are of the same opinion.

Some species of the palm likewise produce sago, though of an inferior quality, and in much smaller quantities.

The most remarkable of these is the Ejoo palm — *Palma Indica venifera.* This tree is remarkable from having numerous black horsehair-like fibres, growing from the base of the footstalks of the leaves, and completely embracing the trunk of the tree. These are capable of being converted into excellent cordage, and are removed with the leaves without injuring the tree. From the pith of this tree a kind of sago-meal is prepared, but not nearly equal in quantity or quality to that obtained from the true sago-tree.

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Quantity of Sago imported into England in		1829	was 486 cwt.
Ditto	Ditto	1830	2677
Retained for home consumption		1829	4026
Ditto	Ditto	1830	3384

Price of Sago at the present time (Nov. 1832), exclusive of duty.

Common Sago from 15*s.* to 16*s.* 6*d.* per cwt.

Pearl ..... 13*s.* to 35*s.* Do.

Duty on importation 1*s.* per cwt.

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CASSAVA.

Jatropha Manihot, or bitter Cassava — and *Jatropha Janipha*, or sweet Cassava — two species belonging to the class *Monœcia Monadelphia*, and ranking in the natural order of *Tricoccæ*, Linn.; *Euphorbiæ* of Jussieu.

This plant is indigenous to South America, where it was found under cultivation by the first European discoverers, forming a great part of the food of the Aborigines. It is still largely grown in Brazil and other parts of South America, as well as in the West Indies. In the eastern part of Mexico it is more cultivated than on the western, and principally on the table lands.

Cassava is likewise produced in the Mauritius, where it was originally transplanted from Brazil. At Madagascar it forms the ordinary food of the inhabitants, whence the French used to distinguish it as Madagascar bread.

Cassava is produced from two species of *Jatropha*. They have male and female flowers on the same umbel. The corolla of the male flowers is funnel-shaped, having only one petal; the corolla of the female has five petals: the seed vessels are three-celled, roundish capsules, containing each one round seed. The leaves grow alternate on long petioles; they are palmate having seven lobes, which are narrow at the base, growing broader till within an inch and a half of the top, where they diminish in an acute point. The three middle lobes are about six inches long and two broad in the broadest part, the two next are an inch shorter, and the two outside are not more than three inches long. The middle lobes are

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CASSAVA—(JATROPHA MANIHOT).

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sinuated on each side near the top, but the two outer are entire. The stalk is slender, ligneous, and knotted, rising from four to six feet and sometimes higher. The root is rough, branchy, and woody, with slender collateral fibres which swell into fleshy conic tubers, similar in shape to the parsnip; these farinaceous roots form the edible portion of the plant for which it is cultivated. The root of the *jatropha manihot* (from two Greek words signifying "a poison," and "to eat,") contains a juice which is highly poisonous, and of which it must consequently be deprived ere it can be used as food.

It is most successfully cultivated in a free mixed soil; the crop is of so exhausting a nature, that it cannot be raised more than two or three times successively on the same ground. When a plantation has yielded three crops at the most, it is abandoned. This plant is propagated by cuttings. Much care is not usually bestowed on the preparation of the land previous to planting. After the ground is cleared, shallow holes are made about ten or twelve inches square, and three or four inches deep; one or two cuttings of six or seven inches long are laid in each hole, which is then covered over with mould. The full grown stem is used for these cuttings as high up as it is tough and ligneous, and well furnished with prominent hardy buds or germs. The work of planting should take place in temperate weather. A dry situation is most congenial to the growth of cassava; when cultivated on moist land, small hillocks are raised, on which the cuttings are set, and from which the moisture may flow, for too much humidity would cause the roots to decay and perish. In the early stage of its cultivation, however, a certain degree of moisture is requisite. The plants generally begin to shoot in about a fortnight. Care should be taken to keep the ground clean until the plants rise to a sufficient height to cover the mould, and prevent the growth of all weaker weeds. In about eight months after being planted the roots are fit for use, but they may be left a considerable time in the ground uninjured; indeed, according to some authorities, they do not attain to their full growth until nearly a year beyond that time; within those periods of their age they are usually dug up as occasion

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requires. The cultivator endeavours to check the growth of the plant upwards, by breaking off the buds; this operation is supposed to give vigour and increase the size of the root. Young plantations often suffer from the depredations of insects and vermin. Wasps attack the roots; while sometimes brown ants appearing in incredible numbers, strip the plants of the leaves and otherwise injure them.

When first taken from the ground, the roots are washed clean, divested of their dark-coloured rind, and then pounded or grated. The Indians of Guiana grind the root on a rough stone, and then press the poisonous juice from it by means of a curious apparatus which they form with reeds. This is in the shape of a long tube having an outlet at only one of the ends, the ground pulp being introduced, the tube is suspended to a tree with the closed end downwards; a heavy stone or log of wood is then fixed to the bottom, the weight of which draws the tube gradually together, pressing out the juice through the interstices.

The pulp is now taken out, and pieces of it are laid on heated stones where they spread themselves into very thin cakes, resembling pancakes in appearance; these are constantly moved about to prevent charring, and as soon as they are crisp they are sufficiently prepared to be used as food.*

In Brazil, where cassava bread is much used, it is prepared on an extensive scale. The peeling off of the rind gives employment to many persons. The roots are there ground by being pressed against the face of a wheel while revolving with great rapidity, the pulp being received into a trough placed underneath for the purpose. In this state it is put into bags and subjected to pressure, whereby the poisonous juice is extracted. It is then baked in thin cakes, in a manner somewhat similar to the Indian method, but more convenient apparatus is employed, a hot iron hearth being substituted for heated stones: when made crisp and sufficiently cool, the cakes are reserved for consumption. If kept free from moisture, they may be preserved in store, uninjured, for a very long period.

* Stedman's Surinam.

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The bread thus made, is considered palatable and nutritious, but it seldom obtains favour among Europeans, whose taste leads them to prefer the leavened bread to which they have been accustomed.

The deleterious nature of the juice is corrected by subjecting it to even a moderate degree of heat, as the poisonous property is extremely volatile. After the roots, cut into small pieces, have been exposed to the action of solar heat, even for a few hours, they become perfectly innoxious, and are used as food for cattle. The juice when recently expressed from the root is immediately fatal to animals, who, after drinking it become much swollen and die in convulsions. But juice in the same state, boiled with meat, proves a nutritious and perfectly harmless soup, and, when seasoned, is a favourite dish of the Brazilians, called by them *casserepo*. This juice, mixed with molasses, is sometimes fermented and made into an intoxicating liquor, which is much esteemed by the negroes as well as the Indians.

The roots of the sweet cassava, or *jatropha janipha*, are very similar to those of the *manihot*. They have, however, two points of difference. The root of the sweet cassava is furnished with a tough ligneous fibre which runs through the heart of the tuber, and this the bitter variety is wholly without; it is likewise entirely free from any poisonous property; but it is not nearly so productive as the former, and is therefore seldom cultivated.

Tapioca is the farinaceous matter of the roots, separated and converted into a kind of starch. This is well known as a light, pleasant, and nutritious diet for invalids. It forms an article of commerce from Brazil, where it is prepared in considerable quantities and exported to Europe.

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ARROW-ROOT.

A product of the Arrow-plant — *Maranta Arundinacea* — belonging to a genus of the class and order *Monandria Monogynia*, natural order *Scitamineæ*, Linn. *Cannæ*, Juss.

The plant from which this substance is obtained, is indigenous to South America, where it was first discovered by Plumier. It was likewise found in great abundance in Vera Cruz. It is now much cultivated in the West Indies, whence it forms an article of export to this country. The *Maranta Arundinacea* has been recently introduced from the West Indies into Ceylon, where arrow-root is now prepared from it, which is reckoned of the finest quality.

This substance owes its English name to another species of plant of the same genus — the maranta galanga — the root of which was formerly applied by the Indians as an antidote against the virus communicated by their poisoned arrows.

The botanical name, *maranta*, was given to it by Plumier in commemoration of Bartholomew Maranta, a native of Venusia, and who was one of the chief Italian botanists of the 16th century. The arrow-root plant is a perennial, having a thick fleshy, creeping root, very full of knots, and with many long white fibres. From this root arise many radical spear-shaped leaves, which are smooth on the upper surface, and somewhat hairy underneath. They are six or seven inches long, and three broad, towards their base, of the consistence and colour of those of the reed. They stand upon slender petioles, which arise immediately from the root: between them several erect

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ARROW-ROOT—(MARANTA ARUNDINACEA).

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herbaceous stalks come out, which rise about two feet high, dividing as they ascend, into two or three smaller branches, each of which is terminated by a loose bunch of small white flowers, standing upon peduncles nearly two inches long. At each joint of the culm or stalk is a leaf of the same shape as the radical ones, but smaller. The flowers are succeeded by three-cornered capsules, each enclosing one hard rough seed.

The plants are propagated by parting the roots. A light loamy soil is most favourable to their growth. When they are a year old, the roots are in a fit state for use. These are then taken out of the ground, and, after being thoroughly washed, are either grated or beaten into a pulp in wooden mortars. In this state the pulp is put into clear water, and intimately mixed with the fluid. The farinaceous parts are thus washed off into the water, while the fibrous portion is separated. This is collected together, and when the moisture is pressed from it, is thrown aside. The white turbid fluid which remains is left for subsidence, after being strained through a hair sieve in order entirely to free it from all the fibrous particles. The supernatant liquor is then drawn off, leaving the starchy matter in a pasty mass at the bottom. Fresh water is added to this; the mixture is again left at rest, and the water drawn off as before. Where much particularity is used in the preparation, this process is repeated a third time, and yet oftener, that every extraneous matter may be dissolved or washed away, leaving the starch in a state of purity. When this desired object is obtained, the moisture is evaporated by placing it on clean cloths, and exposing it to the influence of the sun. When throughly dried it is fit for use. It will keep for a great length of time without spoiling.

EAST INDIA ARROW-ROOT.

Curcuma Angustifoliæ, belonging to the class and order *Monandria Monogynia* — natural order, *Scitamineæ*.

This plant was, a few years back, found growing wild by Mr. Colebrooke, in the forests extending from the banks of

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the Sona to Nugpore, and by him was introduced into the botanical garden of Calcutta. Its bulb is oblong, formed by pendulous tubers. It has narrow lance-shaped leaves standing on long petioles.

An excellent kind of arrow-root, in no way inferior to that from the West, is prepared from this root. The plant grows abundantly on the Malabar coast, where its starchy product is now prepared in considerable quantities, and is become an object of trade with England. This root was long used as an article of food among the natives before it was particularly noticed by Europeans.

The price of arrow-root, inclusive of duty, is from 4*d.* to 1*s.* 6*d.* per pound. The duty is 1*s.* per cwt. for that coming from British possessions, and 18*s.* 6*d.* per cwt. for other sorts.

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COCO-NUT TREE.

Cocos Nucifera — of the family of the Palms — of the class *Monœcia Hexandria.*

THE Coco-nut tree is considered by some writers to be richer in the amount and variety of its produce than any other known plant of the tropical regions, abounding as they do in luxuriant specimens of vegetation. More than one valuable product is drawn from its fruit, besides which, in an earlier state of vegetation, the flower-bud is made to yield its liquid sweets.

This tree is indigenous to Asia and to some parts of Africa. It likewise grows freely in the tropical regions of America; but there is matter of doubt whether it be a spontaneous production of that country, or whether it has been naturalized there from the east. It grows in vast quantities in Ceylon, particularly along the coast between Colombo and Matura, where, for about the extent of a hundred miles, nothing but one entire cocoa-nut garden, with scarcely any interruption, is presented to view. This tree abounds on the coast of Malabar, and in many other parts of Hindostan. It is not generally cultivated in America, except around farms for the sake of its fruit. On the gulf of Cariaco, however, coco-nut plantations are formed very extensively. Humboldt relates, that on the south shore of that gulf, nothing is to be seen but plantations of coco-nut trees, some of these containing eight or nine thousand plants.

The great advantages attendant on the culture of the coco-nut tree have been recognised in Hindostan from the earliest records of antiquity. Among the nineteen castes into which Brahma divided the peculiar people who still venerate him

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as their father and lawgiver, one is exclusively devoted to the cultivation of the coco-nut tree, and to the task of extracting and preparing its valuable products. This caste is one of the highest and most distinguished, and is classed among those said to be of the *right hand*. Chana is the name by which those who belong to it are designated. In so great veneration do the Hindûs hold this tree, that to cut one down is considered almost an unpardonable crime. It is deified in their mythology; this honour, however, it shares in common with many other plants, as well as with the ox and other useful animals.

The coco-nut tree, under whatever aspect it is viewed, whether for use or ornament, cannot fail to be an object of admiration. It presents a picturesque appearance, with its straight slender stem surmounted by winged leaves extending on all sides in a graceful curve, and having enormous fruit pendent in clusters round their base, while its elegant foliage, waving with every gentle zephyr, affords a delicious shade against the rage of a tropical sun; or its numerous palms may become interwoven, and cross the branches of other trees in the neighbourhood without their mutual vegetation being in any way impeded by the contact, thus offering an impervious shelter. Its roots, though they penetrate deep, do not spread far, and, therefore, do no injury to vegetable growth, when even so near as almost to touch it; neither is it detrimental to any wall or building near which it may be placed. The inhabitants of both the tropics are induced by these reasons to plant the coco-palm round their dwellings, and always as near to these as possible. Land planted with it, not only yields an excellent return in its produce, but the most barren soil is improved under this cultivation. Shaded by the wide-spreading foliage, the ground becomes mellow, soon produces good grass, and in a few years is in a fit state to repay its cultivator. Every traveller who treats of this tree appears fully impressed with an opinion of the important place it occupies among the vegetable productions of the tropics. Cordiner observes, "The coco-nut, palmyra, and jacca-trees, may be esteemed the staff of life in

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Ceylon, and a certain resource against the failure of more precarious sustenance. The man who plants any one of these useful trees, confers a lasting benefit on himself, and hands down to posterity more certain riches than can be procured in less genial climates by a life of the most toilsome labour. When the seeds or slips are once put into the ground, they require no cultivation, no pruning, no kind of attention, but spontaneously advance to maturity, and yield a regular and never-failing produce." p. 362.

It is said that all animals delight in the shade of the coco-nut tree, and we are told, that a small bird of Hindostan constructs the nest which is to shelter its young at the extremity of the leaves of this tree. "This nest, interwoven with such art and dexterity, that man may admire but cannot succeed in imitating it, notwithstanding the perfection of his organs, is placed by wonderful foresight at the very extremity of these alæ. Agitated by the least breeze like a cradle, the winds are not able to detach it nor to throw out the young. This sparrow, by surprising instinct, suspends its nest in this manner to secure it in all probability from the attack of serpents, which cannot reach it in consequence of the pliability of the supporters on which it is placed. But what is more astonishing is the care which this bird takes to light its nest in the night time, by fixing glow-worms to the inside of it by means of a tenacious kind of clay." *

The coco-nut tree will not flourish in a latitude much beyond the tropical regions. In the northern hemisphere it is found to vegetate as far as 28° from the equator, and near to the equator it grows from the plains up to the height of 700 toises above the level of the sea. In those climates where the mean temperature of the year is below 77° Fah. this tree will not succeed.

"In the forest the coco-nut tree claims patrician rank." It attains to a greater height than any of the other palms, rising with a smooth, bare stem, less than a foot in diameter, to about seventy or eighty feet in height. This stem is

* M. Le Goux de Flaix, Phil. Mag. vol, xx. p. 332.

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marked with circular rings, and is of an equal thickness throughout, except that it bulges somewhat towards the root where it is covered with a fibrous bark. Pinnated leaves, about eighteen feet long, and from three to four feet broad, radiate from the summit of the tree; they are about twelve in number, and together form a circle, being arranged round the stem like the spokes of a wheel. One ligneous elastic bough, about ten inches in circumference, is the stalk and centre nerve of the leaf from which at each side spring long, narrow, sword-shaped leaflets. These have each a centre nerve, about half as thick as a crow-quill. The flowers grow in clusters, each clustre enclosed in a long spatha or sheath; the spadix or stalk of the cluster is furnished with a great number of branches attached by short pedicles. The flowers on these, which are numerous, are male and female, both growing on the same stalk, the latter in the greatest proportion. Each has a corolla of six equal horned convex petals rounded at their extremity, of a pale flesh colour, and nearly scentless. Some of the flowers, even before the spatha entirely expands, are succeeded by the fruit, which is then exceedingly tender, round in form, and of a whitish hue, by degrees this becomes very large, coriaceous, and fibrous, but of a smooth exterior, usually of a greyish or olive brown colour. The outer husk is about an inch thick, and is composed of fibrous matter. It contains a nut more or less spheroidal, with an exceedingly hard shell of a brown colour, sometimes veined. The cavity of this shell is occupied by the kernel, which is hollow within and contains a milky fluid. The shell is in one entire piece with sutures, which form ridges more or less prominent; in the lower part there is a hole called the *eye* through which the germ issues. It exhibits the marks of two other eyes which have made naturalists suppose that it has three. The fruit hangs abundantly in clusters among the leaves. This prolific tree bears its produce throughout the year. The unclosed bud, the flowers, the tender drupa, the immature nut, in all the different stages of its progress, and the ripe fruit ready to drop on the unwary loiterer, all at the same moment of time appear on one tree in a continuous course of vegetation.

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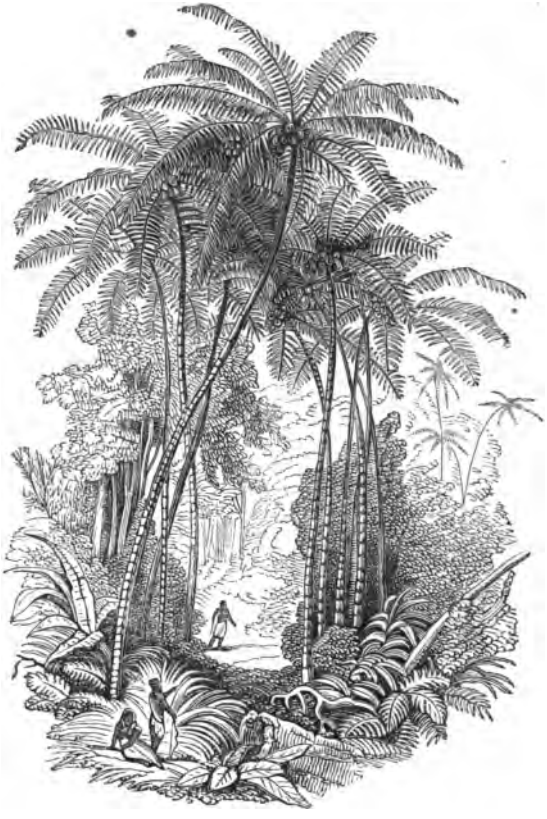

COCO-NUT PALMS—(COCOS NUCIFERA).

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Three species of coco-nut trees are cultivated in Hindostan, and four others in the adjacent isles. The principal, if not the only difference in these species, appears to consist in the configuration of the fruit, which never varies or changes from its respective kind, in whatever country or soil the tree may be cultivated.

The coco-nut of the coast of Coromandel has a smooth shining husk, of a reddish-yellow colour, whence it has obtained the name of the Brahmin coco-nut, because, in its colour, it approaches near to the complexion of the individuals of that caste. The sutures on the opposite side to which the eye is placed become more prominent towards the base.

The coco nut of Canara is perfectly oval in its form, and has a more ligneous and solid shell than the preceding. The husk of this species is green, and has extremely strong filaments. Its sutures are so little defined, as to be scarcely sensible to the touch.

The tree of the coast of Malabar has its fruit turbinated, that is to say, larger at the hole which is formed under the covering that binds and fixes the pedicle of the fruit to its cluster.

The coco-nut of *Achem*, a small island situated on the south side of the Moluccas, is distinguished by its ovoid form, its smallness, and the thickness of its kernel, which leaves scarcely any vacuity within, and therefore contains very little milk.

The fruit of the coco-palm, growing in the Maldives, is very small and quite spherical. Its sutures are all prominent, but more raised on the upper part than opposite to the pedicle.

The species cultivated in the Nicobar Isles, produces larger nuts than any of the other coco-palms. The form of the fruit, before it has been divested of its husk, is triangular; the husk is remarkably thick and fibrous. The nut is a spheroid, a little flattened at the poles, and from the upper pole a sharp point issues; on which account it is called the needle coco-nut.

The fruit of the tree, growing in Ceylon, is a very elongated

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spheroid; it has its suture corresponding to the orifice or eye of the germ more prominent than is found in the nuts of the other kinds of trees.

Every kind of soil agrees with the cultivation of all these species, provided the plants be plentifully supplied with water. The finest trees are found growing in a soft, but not marshy, land, or on a sandy soil. It is often cultivated on harder earth, but its growth under such circumstances is much less rapid; and when in full bearing, the tree is not so productive as those which are raised on a more genial soil. In some situations in Ceylon, it has been known entirely to have failed; but this may, perhaps, have been in consequence of pursuing an injudicious method. Bertolacci recommends a manner of cultivation in hard soil which appears well worthy of adoption. When the plants are three or four years old, the roots have acquired so much strength and tenacity as to be enabled to spread through a hard ground. Care is therefore only required until they arrive at this age; it follows, by consequence, that if artificial beds of good soft mould were prepared for their growth during this period, their after success might be insured in almost any soil. It is recommended that these beds should be about six or seven feet in diameter, and sunk three or four inches below the general surface of the adjacent ground, in order to retain near the roots that moisture, which the wide spreading leaves, from their form and position, collect round their bases, and which thence flow down the stem. Where the land is sloping, the making of these beds is of the first importance, to preserve the moisture requisite to the well being of the plants.

The coco-nut tree flourishes better near the sea-coast than in an inland situation. In such a vicinity it acquires more vigour, and produces with more fecundity; it never grows so luxuriant in the interior, where the air is not charged with saline particles, and salt water always seems to nourish and invigorate it more than fresh water. The sea may wash the bottom of coco-nut trees without injury. "This observation will occur to those who travel along the coast of Malabar, which is covered by an immense and thick forest of these

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palms, and exhibits a most delightful and picturesque scenery."*

In proof of this tree delighting in a maritime situation, Bertolacci says, "it flourishes so very near the sea, that its roots are in many places washed by its waters without injury to the tree, until it is actually undermined. It is likewise remarkable, that those trees which are nearest the shore all bend their heads towards the sea, notwithstanding the violence of the south-west winds, which blow incessantly from that quarter from May to September inclusive; and the regular sea-breezes which prevail in the day, during February, March, and April. In addition to which circumstances, they are perfectly sheltered from all winds blowing on the land side." p. 147.

When a plantation of these trees is made in the interior, at a distance from the sea, it is customary to throw a considerable quantity, as much as half-a-bushel, of salt into the hole which receives the coco-nut.

A tree growing under favourable circumstances, and carefully tended in the first years of its age; protected from the attacks of animals, and from the depredations of certain insects which prey upon it in the first and second years of its growth, will yield toddy or fruit at the fourth, or at most, the sixth year; but if neglected, nothing can be obtained from it until the tenth or twelfth year. The duration of the tree is commonly from eighty to eighty-five years. Its growth is quick until it attains to the age of thirty-five or forty years; this is its most vigorous and prolific period, after reaching which, its developement becomes slower; from the fiftieth to its sixtieth year it yields less abundantly; from that time it gradually declines, and its increase of growth is scarcely ever perceptible. Its beautiful crown loses its verdant colour, and becomes less luxuriant in its foliage; the leaves drop off, a general decay of nature takes place, and if suffered to remain until exhausted by age, it produces little or no fruit in the last years of its life.

If, by any accident, a coco-nut tree should be deprived of

* M. le Goux de Flaix.

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its top, which the Hindûs very expressively call its *head*, the roots cease to acquire nourishment, and the stem is reduced to dust in the course of eight or ten days. In this respect it differs remarkably from other large trees, which being topped, the trunks sprout anew into vigorous vegetation.

This plant can only be re-produced from its fruit, which may be sown in the nurseries in all seasons of the year. For this purpose, the fruit is not divested of its fibrous husk, which in combination with water, is found necessary to facilitate the germination of the seed. The soundest nuts, and those which are not cracked, are selected. The nut is laid longitudinally with a slight inclination, and so placed, that the eye, from which the germ issues, may be presented towards the surface of the earth, and thus allow the shoot to rise at once perpendicularly from the ground.

The nuts are placed in holes of such a depth that they may be covered with nearly half a foot of earth, which is laid over them without being trodden down. Immediately after the sowing is completed, the plantation is watered by irrigation, and not by any other means which might displace the earth, or form it into masses—effects to be carefully avoided. During six weeks or two months, according to the dryness of the season, the watering should be repeated at intervals of every two or three days.

On the eighteenth or nineteenth day after sowing, the point of the germ may be seen issuing from the earth; this is white and smooth, resembling the small tooth of an elephant. The young shoot retains the same form during the space of a fortnight or three weeks. At that period it is extremely tender and of a pleasant saccharine taste, being an excellent esculent, either raw or roasted in the ashes. This delicacy is often served up at the tables of some of the more luxurious of the Europeans in India.

The first leaf is not developed until the thirty-fifth or fortieth day. It appears "like a bundle of small ribbons, shaded with pale flesh colour, and bordered with a band of beautiful green." The root first begins to be formed in the fibrous husk. It appears in filaments, united in groups in the form

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of a very large goose-egg, of a yellowish colour. This, too, is an esculent, as likewise are the young leaves, which, it is said, in delicacy of taste surpass the finest almonds.

About a month after sowing, the roots, assisted by moisture and heat, are formed, and are sufficiently strong to burst the shell on all sides. That shell is of so great solidity and hardness that it can preserve the kernel enclosed in it for years, preventing the evaporation of the aqueous particles within, as well as the desiccation of the milky juice, which is necessary for the developement of the germ. The shell is likewise of service in protecting the nascent roots from the attacks of worms.

About the third month the roots become sufficiently strong to penetrate deep into the earth, and take such firm hold that great strength must be exerted to tear them up. As the plant increases in growth, the roots spread so deep and firm in the earth, that a coco-nut tree is with difficulty uprooted by the most impetuous storm. At the end of the fifth month the young leaves make their full appearance, but the leaflets are still adherent and united, as if the whole were cemented together. This appearance continues with all the new leaves, which shoot out until the twelfth or thirteenth month. All the foliage issues from the head or crown of the stem, and is supported by a fibrous tissue of great strength.

The coco-nut tree is generally transplanted from the ages of eight to fifteen months; but the removing may be postponed, without detriment to the plant, until this has attained to two or even three years' growth. At so advanced a period the operation requires more caution to prevent injury to the roots, for if any of these should be broken they will not grow again, and the whole plant would then infallibly perish.

When planted out, holes at regular distances are made to receive them, from twenty to twenty-two inches deep, and of the same breadth; the earth is then suffered to dry, and a stratum of salt five or six inches in thickness, is put into the bottom of each pit. Care must be taken to transplant the tree with all its roots, and the earth which these retain. It should be placed exactly perpendicular; without this precaution it

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would incline in growing, and, in consequence, would not possess that majestic appearance which a well grown tree presents. Earth is then put into the holes and must be well pressed down that the plant may be secured in its place, and made to retain its vertical position. This work completed, the plants are watered as soon as the sun goes down; they are then covered and kept thus sheltered for nearly a fortnight, to preserve them from the too scorching influence of the solar rays. The irrigations are for a time pursued with diligence.

The Hindû agriculturists have an adage concerning the cultivation of this plant, containing an injunction which they scrupulously follow: "Water me continually during my youth, and I will quench thy thirst abundantly during the whole course of my life." The irrigation should not be neglected till the tree has reached its eighth or tenth year.

Besides this care attendant on its early cultivation, there is another which should be continued through the whole of its existence, to guard it against almost the only evil to which it appears liable. Most of the palms have a very delicate part growing at its summit above the leaves, which is well known as the cabbage of the palm—the delicious-flavoured delicacy of the tropical clime. This part consists of leaves not yet developed, the saccharine qualities of which attract to it a large beetle, armed with two strong *terebiæ*. The cabbage of the palm appears to contain the vital principle of the tree, and it is protected by nature with a covering, through which the insect cannot penetrate. In order therefore, to work a passage into the heart, this winged depredator, pierces the petiole of a leaf, and thus undermines a way to the food in which it delights. It cannot, however, perpetrate this mischief without leaving evidences which are very apparent on a mere examination of the tree.

The chana or cultivator, should then, from time to time, inspect the leaves, to discover whether this injury have been committed. If he sees a hole newly opened, he probes it with an iron dart barbed at the point, which kills the insect and draws it from its retreat, where, if suffered to remain, it might do injury even after its death. In other respects no atten-

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tion is required for the cultivation of this tree; nature takes charge of its growth until the first spatha or flower-bud is produced. Where the plant has been constantly watered, the first bud will appear in the fourth or fifth year, but if it has been left merely to obtain moisture from rain, the flowering will be delayed till the seventh or eighth year. Plants of vigorous growth send forth nine, ten, and even twelve clusters of buds in the year, but those on which little care has been bestowed, and which are consequently feeble, produce only four or five of these spathæ.

The degree of prolificness of this tree is variously stated by different writers. Bertolacci states, that a full grown healthy tree in Ceylon, will yield fifty or sixty nuts in the year. Humboldt quotes the produce of South America as averaging per tree, one hundred nuts annually.

It now remains to speak of the various products of the coco-nut tree and the manner of obtaining them.

Toddy, a well known fermented liquor of the East, and mirra, a much milder beverage than toddy, having neither acidity nor spirit, are both drawn from the flower-bud or *spatha*. From toddy, the best arrack of the East is distilled, and from mirra, a kind of sugar called jagery is obtained.

From the fibrous husk or outer shell of the nut, that part which lies within the smooth covering, a cordage is manufactured, which nearly equals that of hemp in strength, while it is not liable to be injured by immersion in sea water.

The kernel of the nut and the milk within, are both used as agreeable and nutritious aliment, and are too well known to need description. A large proportion of fixed oil is contained in the kernel, which is much used in the East and in South America, and is exported largely from Ceylon to this country, where it is an article of increasing consumption.

The leaves are used entire as mats for sleeping upon. When split through the middle they are woven into mats for covering sheds and houses. On the coast of Malabar, even for the largest edifices, these mats are applied to this purpose. Such roofs are considered preferable to those formed of straw, as they are lighter, equally strong, and more durable, while

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they do not attract rats and reptiles like the latter, The finer nerves of the leaflets are woven into mats for the floors of the wealthy.

If the wood could be employed for building, every part of this tree would minister to the comforts of man. The stem is composed of strong ligneous fibres, crossing each other like net-work; it is not sufficiently hard and compact to be used as timber; but it is extremely elastic during the time it vegetates or retains its sap. M. Le Goux de Flaix states, that it has then such elasticity as to cause a cannon-ball to rebound and be reflected from it. In corroboration he relates that, "a military officer in the service of the French East India Company, who in the year 1760 commanded Fort Alempane, the revetemens of which could not have sustained ten cannon-shot, endured a siege of ten or twelve days; because M. Verri, who had the command there, conceived the idea of causing the facings of the walls to be covered with coco-nut trees, suspended from them. Another proof of my assertion, in regard to the astonishing elasticity of the wood of the coco-nut tree occurred during the memorable siege of Pondicherry, in 1778: a ball fired from the place accidentally struck a coco-nut tree in an avenue opposite to it and perforated the body of the tree, which bent and suffered it to pass through it, as if it had gone through a mattress. The trunk then closed up, bringing together all the ligneous needles of which it was composed; and at the time the place surrendered, the wound was perfectly healed.

"I mention these facts, that advantage may be taken of them, should urgent circumstances render temporary fortifications necessary in a country where coco-nut trees can be readily obtained. I was sensible of the utility of it during the siege of Pondicherry in 1778, at which time I caused the merlons of the ramparts to be covered with it."*

Toddy is drawn during six or eight months of the year; the tree being left to recover its strength through the dry season. At the end of the fifth or sixth month, from the

* Phil. Mag. vol. xx. p. 321.

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first appearance of a bud on a vigorous tree, it is in a fit state for extracting this liquor; but if the tree be in a feeble state of vegetation, the spatha will scarcely have arrived at that point in the tenth or twelfth month. If tapped at too early a period the plant soon becomes exhausted. At the proper period the spathæ are from one and a half to two and a half feet long, and about two or three inches thick in the middle. They are of an elliptic form, a little bent and pointed. Either toddy or mirra may be obtained from the same spathæ; the latter, however, is always clearest and sweetest when extracted from those which are young. Both these beverages are, in fact, the same liquor, their difference arising only from difference of management.

The smooth and lofty stem of the palm is difficult to be ascended, since there is no hold by which the climber can reach or retain his place during the operations necessary for obtaining the liquid. The *chana* materially assists himself in this labour by the use of a very elastic leather thong, having a strong slip knot at one of its extremities and being open at the other end. He secures this thong round his body just below the armpits and also round the stem of the tree. His heels are at the same time kept together by a strong elastic ring made of rush. He then places his feet against the tree, and raising the leather thong round the stem to about the height of his head, he prepares to climb by elevating his feet, supporting himself by the thong and by the left hand applied to the tree; the right hand directs the thong, which is raised again as soon as the feet have mounted and taken firm hold. This operation is repeated till the summit is reached, when he slips the thong down to his reins; the elasticity of the thong enabling him readily to manage it with one hand, either in ascending or descending. Placed at the top of the tree, seated on his thong; he balances himself with his feet and body and his hands are left at perfect liberty to perform his work. The implements employed are very simple. A small coffer made of the spatha of the coco-nut tree, and which serves to hold his knife, is fastened round the body of the chana, and rests on his left thigh: a basket formed of the leaves of the *tontaras*, so ingeniously interwoven

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as to retain the liquid collected in it without suffering any to filter through, while climbing is held by the chana in such a manner, that it does not in any way impede his movements: a conical instrument used in breaking and bruising the buds, and a small box containing the dust of a kind of mica employed for sharpening his knife:—these make up the whole apparatus with which he provides himself. Thus prepared, he ascends with a velocity which the eye can scarcely follow. Thirty or forty seconds suffice him to reach the summit of the highest tree and arrange himself for action.

The first operation is to prune away the leaflets from the bases of the petioles, in order that the spathæ may be more readily got at. A piece of the bark of the petiole taken from the under side of a leaf is then torn off through its whole length. With this, he binds the spatha round, beginning with the peduncle; he strongly compresses and ties with fast knots each annular mark, which are rather more than an inch apart from each other. This is to prevent the bud from blooming, when it is cut each time after the liquid has been collected. The bud being thus bound, it is bruised with a bat made of hard wood, with which it is slightly struck on every part; without being thus beaten, the juice would not flow. This operation, which takes up only a very few minutes each time, is repeated regularly every morning and evening for five or six days, and after that two or three times during the flowing of the liquor. A spatha subjected to this treatment continues to give out its fluid product for twenty or thirty days.

Fruit cannot, of course, be produced in those flower-buds which are cut for toddy; all the flowers being compressed by the ligature, necessarily become abortive. On about the fifth day a piece of about the length of two or three inches is cut off from the extremity of the spatha, with a sharp knife, shaped like a crescent leaving the part quite smooth. The liquid does not begin to flow until the second and sometimes the fourth day after the spatha has been cut. As soon as the drops begin to exude, they are received in an earthern pot tied under the part for that purpose.

When mirra is required, the vessels are changed twice a-

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day, and each is well cleansed and dried before it is again employed. But if toddy is to be obtained, the pot is merely emptied as it becomes full and is not changed. This causes it to acquire a strong acid smell, and excites to fermentation the liquid flowing into it; heat is in consequence generated, and this disposes the bud to draw from the tree a greater quantity of juice than when clean pots for mirra are used. From this cause one spatha will yield one third and sometimes one half more of toddy than it would of mirra. A good bud properly prepared will give nearly a quart of mirra in the course of the day, or a proportionate greater quantity of toddy.

The end of the spatha whence the liquid flows must be frequently cut off, otherwise the viscosity of the juice, which concretes on the outside, would prevent the liquor from flowing. The quantity drawn is, however, in some measure proportioned to the strength of the tree, and the care which has been taken in its management. Frequent irrigations, and the sprinkling of salt three or four times around the roots, are recommended as certain means of strengthening the plant, and of causing it to produce abundantly. Three or four buds of a vigorous tree may be made to yield liquor at the same time; but the tree would soon be exhausted if all the buds produced in the year were appropriated to this purpose. On that account, at least, one bud in three should be left for fructification.

When mirra is drawn to be used merely as a beverage, nothing is put into the vessel receiving it; but if the intention is to make jagery from it, a small quantity of the bark of a tree, called *hall-gass*, is scraped into the pot. This has the property of fining the mirra, and of producing a quicker condensation of it, when exposed to the action of heat. The bark is, however, strained from the liquor previously to its being subjected to ebullition; this should be conducted very gently over a slow fire until it acquires consistency. During this process, the scum must be taken from its surface, from time to time, and it must be frequently stirred. It then turns to a whitish hue. When evaporated to about the thickness of cream, a small quantity of jagery already hardened is put into the boiler and stirred till it is melted, and incorporated with the rest. The whole is then

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poured into coco-nut shells, where in a few minutes it becomes of the consistency of sugar, and is fit for use. If not evaporated sufficiently to allow of its taking this form, it takes the appearance of molasses, in which, part of the jagery crystallizes like sugar-candy. Some manufacturers use lime in small quantities, which assists very much to inspissate the juice; even without boiling, it will then by mere desiccation in the sun, crystallize into coarse sugar. Lime, however, has the disadvantage of darkening the colour of the jagery, and of rendering it less wholesome, as well as inferior in taste. The mirra abounds in saccharine matter, and yields jagery very abundantly. Bertolacci says, "I have seen one gallon of mirra produce one pound and a half of good fine jagery."

Jagery, besides being used in the same manner as sugar, is employed by the Hindûs in masonry with great advantage. It is said, that the indestructibleness of some of their buildings is caused by the use of this substance. The following passage furnishes an example, as well as shows the manner of its use.

"Works constructed with cement, or mortar, moistened with water, in about a hundred quarts of which, from fifteen to twenty pounds of this sugar have been diluted, acquire such solidity and tenacity, after complete desiccation, that the bricks, or stones, cannot be disunited even by the greatest efforts. I mention this fact on the authority of experience; the best and strongest tools in performing this labour are broken. To prove my assertion, I shall mention the experiments I made in the year 1769, when the fortifications of Pondicherry were repaired. The chief engineer, being desirous through economy to employ part of the old walls, gave orders that they should be cut into blocks to serve as a foundation for the new ones; this labour occasioned more expense than if new materials had been purchased, in consequence of the loss of time, and the number of tools that were broken during the operation: as a last proof of this assertion I shall mention, that I have seen the halves of large arches remaining suspended, though the other half had been destroyed by the effects of mines, employed at the time when Pondicherry was

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destroyed in the year 1761. Immense fragments of these arches are still to be seen in the house of the Jesuits, or in the ruins of the superb government house, built by the order of Dupleix.*

Arrack is obtained by distillation from toddy, in the same manner that brandy is obtained from wine. Four parts of toddy distilled gives over one part of weak spirit, and this yields, by a second distillation, half its quantity of a spirit about the strength of good brandy. The Hindûs usually add, before distillation, water impregnated with the flowers of a shrub called *moué*, which have the aromatic odour of cinnamon combined with anise. This, it is said, prevents the spirit from acquiring an empyreumatic flavour.

Toddy, when kept longer than a fortnight, passes into the acetous fermentation, and is, therefore, no longer in a fit state for distillation to obtain alcohol. The first weak spirit drawn over can, however, be preserved for some months without injury. Toddy, likewise, makes very good vinegar, which improves with age, especially if a small quantity of the bark of the moringa be infused in it.

Mirra and toddy are obtained also from the palmyra-tree,† which grows in great abundance in Ceylon, in the districts of Manar and Jaffnapatam; but the products of this tree are not considered equal to those of the coco-palm. The *caryota urens*, or jagery-tree, so called from its fruitfulness in producing sugar, likewise affords a similar liquor.

Arrack forms a principal article of export from the island of Ceylon. The average quantity shipped during the eight successive years preceding 1813, was 5200 leggers of 150 gallons each, at 80 rix dollars‡ prime cost; 25 for the cask, and 8 for the duty.

The filaments of the husk of the coco-nut are manufactured into cordage of great strength and durability. Such is generally employed in Asia for cables, it being light and elastic; a ship rides easy with coir cables, since six inches will stretch into nine without breaking.§ No tar is required to give to

* M. le Goux de Flaix, Phil. Mag. vol. xx. p. 331.

† For a full description of this plant, see Cordiner's Ceylon.

‡ The rix dollar of Ceylon is worth about 1*s.* 9*d.*

§ Tennant, p. 214.

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this cordage strength or durability. If it be fully wetted with sea-water it will continue fresh and durable. It is preferred as running rigging for ships by all who have used it; although hard to handle at first, it soon becomes pliant. Ropes made of this material have always been used in the East, yet coir has been introduced only recently into this country; its value is now beginning to be fully recognized, so that the demand for it is annually increasing. It is sometimes used in our navy for cables and for running rigging. It is more bulky than hempen ropes, but at the same time is more buoyant, and its property of not being injured by sea-water, must always render it valuable for use about ships.

While the Dutch governed Ceylon, coir was considered of sufficient importance to be made, according to their usual policy, an exclusive article of the company's trade, and it is supposed that 3,000,000lbs. were annually manufactured there. The port captains of Point de Galle and Colombo had the privilege of causing to be made, and selling for their own benefit, the former 500,000, and the latter 600,000lbs. of coir.

This material was collected by the officers of revenue at a fixed price, and the trade in it was among those destructive monopolies which are of doubtful profit to the government, and benefit a few individuals, while they paralyze the industry, and prevent the prosperity of the many.

Since the possession of Ceylon by the English, the manufacture of and trade in coir have been thrown open; an *ad valorem* duty of only 5 per cent. being levied on this article.

The quality of coir differs very much according to the manner of preparing it. That which is fine will command double the price of coarse coir. A clear yellow colour, and fineness and evenness of filament, are the qualities indicative of good coir. Cordage made of this is not only more pliable and smooth, but it is in reality much stronger than that made of the coarser kind. The filaments of the latter are thicker in consequence of their not having been properly cleansed from a pulpy substance which adheres to them in their unprepared state, but which in

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fact gives no strength. To clear it from this and other heterogeneous matter, the husk is steeped in water during several weeks. Clear running water should be used for the purpose; for if stagnant, it very much injures the strength of the material, which then assumes a dirty grey colour. A fine yellow hue indicates that it has been properly steeped.

Oil expressed from Coco-nuts has been long employed among the Eastern nations to feed their lamps, and it is applied to the same purpose in some parts of South America. The plantations of this tree already mentioned as cultivated along the coast of the gulf of Cariaco, are appropriated to this sole use; the fruit is conveyed in large quantities to the town of Cumana, where the oil is expressed, and becomes an article of great trade. In other parts of America the value of this oil is in the present day becoming better known, but this knowledge might with great advantage be still more widely diffused.

The proprietor of a sugar estate in Jamaica, who is known to the author and resident in England, had been in the habit of annually shipping a quantity of lamp oil for the use of the boiling-house; but within the last year or two has withheld these supplies, giving directions that the oil required should thenceforth be obtained from the coco-nuts growing on trees which were already ornamenting his estate. This has been done without difficulty, and this branch of expense has been thus avoided.

In Trinidad, coco-nut oil is universally used for lamps; it is produced there beyond the consumption of the island, and forms an article of export to some of the neighbouring isles. Plantations of trees have been formed, and a steam-engine is employed for expressing the oil; but it is not at present produced in Trinidad at a very cheap rate, since it is but little cheaper there than the price at which it can be obtained for consumption in England.

In Ceylon the number of coco-palms is already so great, and the means of increasing them to an enormous extent are so completely within reach, that if the consumption of this oil were generally adopted in England, it might continue to

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be obtained at a reasonable rate, while it would become a great source of revenue to our eastern dependency. The various products of the coco-palm are exported from the western coast of Malabar in considerable quantities; and to the estimated value of one hundred lacs of rupees.

This kernel is very rich in oil; which is either extracted from the nut when quite fresh, the shell being newly broken, or the kernel is cut in slices, and exposed to the action of the sun until all the aqueous particles are evaporated, and only the oily portion remains. In this latter state it is called copperas, and forms an article of export from Ceylon. The oil extracted from this has, however, a strong rancid smell, and is very inferior to that expressed from the fresh kernel. The separation of the oil from the copperas is very clumsily performed by the natives in a mill of rude manufacture worked by bullocks. When the oil is extracted from the coco-nut at once, the shells are broken with sharp-edged tools, and the kernel immediately scraped to a pulp; this is boiled in water, and the oil, as it rises, is skimmed off: when thus obtained, and fresh, it is very palatable, and many of the native families use it for culinary purposes. This simple method of collecting the oil is not, however, as economical, as efficient, or as expeditious as the mode of expressing it by the assistance of machinery.

This oil was first sought to be introduced into consumption in this country in 1814, and at that time, much attention was directed to the discovery of the best means for extracting the oil from the kernel. Accordingly, Mr. Hoblyn, a gentleman much interested in the subject, caused an apparatus to be made, which was thought well adapted to the purpose. Several of these pressing machines were sent out to the island, and considered successful in their application. The apparatus is very simple in its construction. A cylinder, covered with plates of iron having perforations, in the manner of a grater, is made to revolve in a kind of box, the two sides of which form an acute angle at bottom. The kernels being put into this box, are scraped by the motion of the cylinder, while at the same time they are pressed down to the angular part, where they

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are confined close to the cylinder, till they are reduced to a pulp. In the same machine is a perforated box fitting into a case, the pulp is conveyed to this receptacle, and by means of a lever, pulley, and rollers, a mallet is made to move up and down into the box, pressing down the contents from which the oil escapes into the case, whence it is drawn by means of a sluice. This machine being placed on wheels, is readily moved, and therefore, a single one may, if necessary, be rendered available for the use of several manufacturers.

Bramah's hydrostatic press has likewise been recommended for the purpose of extracting the oil. The kernels being reduced to a pulp are put into woollen bags, which are placed in a hydrostatic press having iron plates placed so as to separate the bags from each other; the oil is then pressed out at the sides and runs into a trough placed beneath. The refuse matter is then considered to be good food for cattle. The relative produce of oil obtained from one tree of course varies; they reckon in Cumana, that rather more than twelve nuts will produce one flasco of oil;* and it is stated by Koster, in his work on the Brazils, that from forty nuts he obtained seventeen pounds of pulp which yielded three pounds of pure oil.

This oil congeals at a temperature of 70° Fahr. which has formed a great objection to its use in temperate climates. When it was first introduced into this country many active means were taken to promote its adoption and consumption. Some lamps were constructed in which this oil could be burnt, but a thick opaque substance somewhat resembling tallow though not quite so consistent, was not adapted to come into competition with the pure limpid fluid usually employed for illumination, while some trouble was necessary for its proper management. This reason rendered its introduction for that particular purpose very circumscribed, but it was found that it could be made to form one of the ingredients in soap, the quality of which was very superior to that made from tallow, at an enhanced price of only 10 per cent.

* A flasco contains from seventy to eighty cubic inches of the Paris foot, and would therefore be something less than a pint and a half English measure.

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A discovery has been recently made the object of a patent in this country, which entirely removes the objections to the use of coco-nut oil for lamps, and holds out a prospect of its more extensive consumption. By this invention the concrete part of the oil is separated from the fluid, leaving a perfectly pure and limpid oil, in every respect as well adapted for lamps as the best sperm oil. The solid unctuous residue is likewise available for many useful purposes in which materials of such a nature are required.

This separation is effected by means of pressure. The concrete coco-nut oil imported into this country, is put into strong linen bags, these covered with thick sack-cloth, are laid flat upon the horizontal bed of an hydrostatic press, a small space being left between the bags. They are then subjected to strong pressure which is continued as long as any oil flows through into a cistern placed beneath for receiving it.

The liquid oil thus expressed, is then left at rest for the subsidence of its impurities, after which a limpid, colourless, fluid is drawn off, which makes an extremely good lamp oil, free from all smell, and giving a pure and steady light. It is sold at a much cheaper rate than sperm oil of a tolerable quality.

The residue in the bags, after the extraction of the fluid part, contains many impurities, such as fibre, mucilage, and other extraneous matter. To disengage it from these, the whole is put into a tinned-copper boiler which is covered and submitted to heat immersed in a water-bath, to prevent any liability of an excess of heat which might be contracted if exposed to the naked fire, and which would materially injure its quality. Sulphuric acid, of 1·8 specific gravity, is then added, in the proportion of two per cent. in weight. The combined action of these two agents, heat and acid, coagulates and precipitates the impurities, which may be removed by filtration when warm, or by subsidence after the whole becomes cold and assumes a solid form. The substance thus obtained is entirely free from all unpleasant odours, is of a firm consistence, and of a fine glossy whiteness. It is manufactured

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into candles, which, in their appearance and use, are much superior to those made of tallow, burn with a pure white flame, and emit a steady light, but not quite so intense as that of tallow candles. They are sold at rather a higher price than the latter. The price of cocoa-nut oil (Nov. 1832), is from thirty-five to thirty-six pounds per ton, and the duty charged on its importation, is two shillings and sixpence per cwt.

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CINNAMON.

Laurus Cinnamomum — belonging to a genus of the class and order, *Encandria Monogynia.*

It is probable that cinnamon was known to the ancients at a very early period. We find mention made of this aromatic more than once in the bible — in Exodus, chap. xxxiii. v. 23; in the Songs of Solomon, chap. iv. v. 14; and in Proverbs, chap. vii. v. 17. It was likewise known to the Greeks and Romans, but being supplied to them from Arabia and the north-east coast of Africa, it was naturally, though erroneously, supposed to be the produce of those countries. The Arabians, however, brought this article of merchandize from India, whereto it might easily have been conveyed from Ceylon, and whence it was transported to the shores of Arabia, thus giving rise to the fable which invested with spicy odours the Sabean coast.

The Arab merchants intentionally shrouded in mystery the manner of obtaining cinnamon, and in consequence, the ancients entertained the most preposterous ideas on the subject.

Herodotus relates that cassia grew in Arabia, but that cinnamon was brought thither by birds from India, the fabled birth-place of Bacchus. This writer stated that cassia grew in a shallow lake, the borders of which were infested by winged animals, resembling bats; that these were powerful creatures, and uttered piercing cries, but that the Arabs made war against them, for the purpose of obtaining the spice; and, defending their eyes from the attacks of the monsters, drove

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them from their strong hold for a brief period, and then, unmolested, collected the cassia.

A still more marvellous account was given by the Grecian historian of the manner in which cinnamon was obtained. According to him, the Arabs themselves were perfectly ignorant of the situation of the favoured spots which yielded this spicy produce; some, however, asserted, with much appearance of probability, that it grew in the country where Bacchus was born: they gave the following account of the plan resorted to, for acquiring cinnamon. Some very large birds collect together a quantity of the shoots and the small branches of the tree bearing cinnamon, with these they build their nests on lofty mountains inaccessible to man. The inhabitants of the country make use of an ingenious contrivance to obtain the materials of these aerial abodes. They place large pieces of carrion flesh near to the haunts of the birds, who seize with avidity on the prey and bear it to their nests, which not being made sufficiently strong to bear this additional load, the fabric gives way, the pieces of cinnamon fall to the earth; the natives carefully collect and export them to foreign countries.

Such is the account of an historian, whose accuracy and fidelity of relation is rarely questioned. It furnishes a forcible example of the extreme ignorance of the ancients, as to the origin of eastern productions.

The great additional expence incurred in the transport of oriental merchandize in those days, when it came through a circuitous route both by land and sea, and the risk and uncertainty attending the navigation, considerably enhanced the price of these articles, causing their use to be confined wholly to the wealthy and luxurious; who, however, consumed cinnamon in profusion, but more for its odorous qualities, in the manner of incense, than as an addition to food. It is recorded that two hundred and ten burthens of spices were consumed on the funeral pile of Sylla, and that Nero burnt at the obsequies of his wife, Poppæa, a quantity of cinnamon and cassia exceeding the whole importation of one year.

Even in comparatively modern times, the products of the more eastern parts of Asia were chiefly imported into Europe,

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by the way of Egypt. The Venetians almost entirely engrossed this lucrative branch of commerce, and through their hands these articles were supplied to the rest of Europe. But when the passage round the Cape of Good Hope was discovered by the Portuguese in 1498, Indian commerce was turned into a different channel, and the Portuguese soon supplanted the Venetians in the traffic with Indian commodities. Early in the sixteenth century they obtained permission from the powers at Ceylon to establish a factory in that island. Though the Europeans had thus licence from the ruling authorities to prosecute this trade, the Arab merchants did not submit, without a struggle, to this intrusion. They vigorously opposed the landing of the strangers, perceiving at once in their establishment, the total downfal of that monopoly of the cinnamon trade which they had so long enjoyed. Notwithstanding these hostile efforts, the Portuguese succeeded in erecting the fort of Colombo. Soon after this undertaking was accomplished, they had the address and good policy to make a treaty with the king of Candy, by the terms of which the Portuguese engaged to assist the king and his successors in all their wars, and in return were to be furnished out of the Candian territory with an annual supply of 124,000 lbs. of cinnamon.

The Dutch viewed, with a jealous eye, the rich and thriving settlement of the Portuguese; and, soon after they had established themselves in the East Indies, became desirous of monopolizing the cinnamon trade. With this view they sought to undermine the Portuguese in the favour of the king of Candy, with whom they so far ingratiated themselves, as to induce him to enter into a negociation with them, which had for its object the driving of the Portuguese from the island. They were so far successful that, in 1612, the king entered into an engagement with the Dutch East India Company to sell to them all the cinnamon that could be collected in his kingdom. The Portuguese did not, however, quietly submit to this arrangement; and, after long contesting the matter, entered at length, in 1645, into a treaty of peace with the Dutch, whereby it was arranged, that thereafter the

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cinnamon trade should be divided equally between the two nations. During the period in which this treaty was in force, both parties employed native cinnamon cutters, or *chalias*, to cut and prepare the aromatic bark; and all that was collected on either side was deposited in a central situation upon the river Dandegam near to Negombo. When the cinnamon harvest was completed, an equal division of the quantity obtained was made, and each party paid to the *chalias* half of the stipulated price for peeling and otherwise preparing the whole.

This amicable arrangement was not, however, of very long continuance; and, in 1652, fresh occasion was found for war, which proved most disastrous to the Portuguese, who were finally expelled from the island of Ceylon in 1658. The Dutch now made strenuous efforts to obtain a strict monopoly of the supply of cinnamon. For this purpose they endeavoured to engross the exclusive commerce of the Malabar coast, and drove thence the Portuguese, while they prohibited the natives from supplying the English with produce under penalty of confiscation.

Their perseverance in this arbitrary course was most expensive, while it proved inadequate to insure a total exclusiveness of the trade. Merchants of other nations, by paying an enhanced price for the articles they desired, were always able to obtain them from the natives, notwithstanding the decrees of the princes of the country; and the wild cinnamon of Malabar, under the name of cassia, still found its way to Europe by other channels than that of Dutch commerce. Holland, however, continued for many years to enjoy the exclusive trade of the cinnamon of Ceylon, and the Dutch East India Company evinced much anxiety that the produce from this island should always retain a decided superiority over that of any other country. Notwithstanding, however, their repeated injunctions, that none should be exported which was not of an excellent quality, they often had reason to complain that the shipment of an inferior kind was allowed. The cause of this disregard to orders was said to have arisen through the requirement by the home authorities

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that a larger quantity should be consigned to Europe than could be procured of good quality.

Meantime the Dutch became seriously alarmed at the gradual but steady encroachments in the cinnamon trade of other nations. Although the Dutch extirpated the trees wherever they could find them on the coast of Malabar, yet a large quantity was annually obtained thence, which rendered the monopolizers still more desirous that their Ceylon cinnamon should be so undoubtedly superior as to allow of no competition.

Although the difficulty of obtaining a sufficient quantity from the king of Candy's territories was constantly and increasingly felt, yet the Dutch still continued entirely to depend for their supply on the produce of the uncultivated trees growing in Candy, and never turned their attention to the cultivation of cinnamon trees in their own territories, whereby they might have become independent of the Candian kingdom.

They, however, clearly saw that their trade must decline unless a sufficient exportation of the best article should, from the comparison; cause that of inferior quality to get into disrepute, and prevent its sale at prices which would yield any profit to the importer.

The importation of cinnamon into Holland did, in fact, gradually lessen, until, at length, the Dutch were induced to adopt the most efficient and sensible method for retaining the superiority of their cinnamon by obtaining an unfailing supply. This method was to cultivate it in their own territory. So simple and rational a plan was not, however, accomplished without calling for great exertions in combating many prejudices, and in removing many obstacles. On the one hand the natives were of opinion that the tree, in a state of cultivation, would not yield so good cinnamon; while the supreme government of the Dutch East Indies considered it a wasteful and useless expenditure to form plantations of a tree the produce of which could be obtained from plants of spontaneous growth.

Falck, who was governor of Ceylon in 1765, and during se-

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veral subsequent years, was enlightened enough not to be influenced by either of these objections. Trial was made on a small scale with perfect success, and the governor clearly saw the great advantages likely to accrue from establishing more extended plantations. With undeviating perseverance he pursued his course; nor could he be turned aside from the prosecution of a plan which he knew would prove so beneficial to the settlement. Fortunately, his successor was equally convinced of the importance of this plan, and pursued with equal zeal the cultivation of the cinnamon plantations which M. Falck had established.

The labour of clearing and planting was chiefly performed by the natives, who, being incited by the promise of rewards and honours, continued their work with tolerable alacrity. To cut the shoots and prepare the bark was a work exclusively confined to the government peelers; any other persons convicted of cutting, or otherwise destroying cinnamon trees, were visited with heavy penalties. Indeed, the importance attached by the Dutch to the cinnamon trade, cannot be better shown than by the rigour with which the smallest interference with it was punished. "The selling or giving away the smallest quantity of cinnamon (even were it but a single stick), the exporting of it, the peeling of the bark, extracting the oil either from that or the leaves, or the camphor from the roots, except by the servants of govern ment,and by their order, as well as the wilful injuring of a cinnamon plant, were all made crimes punishable with death, both on the persons committing them, and upon every servant of government who should connive at it."*

The Dutch soon had reason to congratulate themselves on the step they had taken to become independent of Candia, since every year brought with it increased difficulties in obtaining a supply from that territory.

By the year 1793, their plantations were sufficiently extensive, and matured to allow of the whole annual supply being drawn from the Dutch possessions alone.

When Ceylon was captured by the English in 1796, the

* Bertolacci's Ceylon, p. 241.

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cinnamon found in the store-houses was sold by the conquerors to the East India Company for 180,000*l.*; and, in the latter end of the ensuing year, 13,893 bales were brought into England.

The English government continued to pursue the same line of policy which the Dutch had followed with regard to this branch of commerce. The natives, as well as all other persons, were strictly prohibited from trading in cinnamon. A regulation was made, sentencing to confiscation every ship on board of which more than 20 lbs. of cinnamon should be found that had not been embarked by authority of government, and where the quantity was less than 20 lbs. exacting a penalty of fifty star pagodas for every pound.

The manner of conducting the cinnamon trade when Ceylon first fell into the possession of the English, does not appear to have been particularly happy. The governor, influenced by the representatives of Mr. Jonville, a French gentleman who held an appointment in the cinnamon department, became fearful that the extensive plantations might yield too great a quantity of cinnamon, and recommended that part of the trees should be extirpated. This hasty and inconsiderate advice was not, however, immediately adopted.

After the peace of Amiens, under the provisions of which Ceylon was formally ceded by the Dutch to the British government, a new arrangement was made, and the Governor-General of India had no longer any controul over the Governor of Ceylon. It was, however, considered advisable that the East India Company should still enjoy the monopoly of the cinnamon trade. An agent was, therefore, appointed to reside at Colombo for the purpose of receiving the cinnamon collected by government. It was stipulated that four hundred thousand pounds, or about four thousand three hundred and twenty-four bales of ninety-two and a half pounds each, were to be thus furnished. Any quantity which might be collected beyond this was ordered to be burnt, while the home government recommended that the cinnamon plantations should be limited to the quantity requisite for obtaining this amount.

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So unadvised a recommendation appears to have been made in consequence of an erroneous opinion respecting the ease with which cinnamon could be collected, and the facility with which it might be cultivated. This is not the only instance which could be furnished of the disastrous effects produced by the system of legislating at a distance, on subjects which require local knowledge for their proper management. Government, fearful of producing too great a quantity of cinnamon, had now recourse to that system recommended by Governor North, and ordered many of the cinnamon plantations to be rooted up. It was fortunate, however, that this business of destruction was a work of labour, and was often evaded by the purchasers of the plantations; since the annual supply soon became much reduced in quantity, and was collected with difficulty. Notwithstanding the unlooked-for addition thus obtained from the produce of the rescued trees, the whole quantity furnished fell far short of that stipulated in the agreement. As soon as General Maitland assumed the government of Ceylon in 1805, he became fully aware of the impolicy of the recent proceedings, and while one of his first acts was to stop the progress of destruction, he took every means to encourage the more extended cultivation of the cinnamon-tree — a line of policy likewise pursued by his successors.

The system of forced labour which prevailed in Ceylon, when we first acquired the island from the Dutch, was long continued and exacted from the native population with a degree of severity which would scarcely be believed by any who have not witnessed it. In many instances the natives have been forced to labour without being paid for their services; and to such an extent has the vile monopoly of cinnamon been carried, that if in the garden of any person a cinnamon-tree should happen to spring up, the owner of the garden could not consider it as his own property, neither might he remove it, but was compelled to nurse and rear it for the government; and by the Dutch law, if a man were found cutting down a cinnamon-tree, he was liable to have his right hand cut off.*

* Report of Committee of House of Commons on East India Affairs, 1831.

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The enlightened policy of the present day has happily put an end to a system productive of so much cruel oppression; and by an order of the government, bearing date October, 1832, the cinnamon trade is declared free.

Marshall, in his description and history of the *laurus cinnamomum*, given in the tenth volume of the "Annals of Philosophy," assigns very extensive limits to the cultivation of the cinnamon-tree. He states, from good authorities, that this plant is found on the Malabar coast, in the island of Sumatra, Cochin China, Tonquin, the Sooloo Archipelago, Borneo, Timor, the Nicobar and Philippine islands. It has been successfully cultivated in the isle of Bourbon and the Mauritius.* In the Northern Circars, on the estate of Messrs. Beaufoy and Co. at Trevancore, the first object has been to naturalize and cultivate cinnamon. For this purpose seeds and plants have been procured from the island of Ceylon, and cinnamon cultivators engaged. This plantation has only been a few years in progress, and its success is not yet ascertained. Into the island of Du Prince, on the east coast of Africa, the cinnamon-tree has been transplanted, and likewise into the Brazils, Tobago, Guadaloupe and Jamaica. This plant was introduced into Guiana in the year 1772, from the isle of France, and the inhabitants now cultivate it in their gardens and round their cottages. In this manner they prepare cinnamon in sufficient quantity for domestic purposes, and transmit a small quantity to France.

The roots of the cinnamon-tree are branchy and ligneous; the bark of these roots has the pungent smell of camphor, with the delicious odour of cinnamon, and yields camphor by distillation. The wood of the tree is light, fibrous, and inodorous. The trunk is from twelve to eighteen inches in diameter, rising to the height of from twenty to thirty feet; it grows irregular and knotty; the external bark is thick, rough, and scabrous, and of an ash-colour; the inner bark is reddish. The bark of the young shoots is often speckled with dark-green and light orange colours. The branches are thick and

* In 1785, 3000 cinnamon trees were flourishing in the Isle of France.

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CINNAMON TREE—(CINNAMOMUM VERUM).

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spreading, and shoot forth horizontally or inclining downwards; they are covered with numerous oblong leaves growing in pairs opposite to each other. When first developed these leaves are of a bright red hue, then of a pale yellow, and, when arrived at maturity, of a dark olive colour. At full growth they are from six to nine inches long, and from two to three inches broad. The upper surface is smooth and shining, and of a darker green than the under side. The petiole has the odour and taste of cinnamon. The plant blooms in January and February, and the seeds ripen in June, July, and August. Many white flowers grow on one peduncle; they have no calyx. Their smell is, though not strong, exceedingly pleasant, resembling a mixture of the rose and lilac. The fruit is an oval berry, larger than a black currant, and adheres in the manner of an acorn to the receptacle, which is thick, green, and hexangular. The leaves, when full grown, emit a strong aromatic odour on being bruised, and have the pungent taste of cloves.

Crows and wood-pigeons devour the berries with great avidity; in passing through them the productive qualities of the seed remain unimpaired, and by this means the plant is disseminated over a great extent of country, it being found even in the thickest and most impassable jungles. Cattle of all descriptions eagerly feed upon its foliage. When the berries are first gathered, their taste resembles that of the juniper-berry; they soon become dry, and then assume the form of a small kernel contained in a thin shell. If boiled they yield an unctuous substance, which, when cold, becomes solid like wax. It emits an agreeable odour, and may be formed into candles, which formerly were reserved for the exclusive use of the Candian court.

The prepared bark of this tree is the cinnamon of commerce. Diversities in the quality of cinnamon do not appear to arise from any varieties of the plant, but from care and skill in the preparation, the soil and exposure of the country, the age and health of the plant."* It is rarely

* Annals of Philosophy, vol. 10.

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found worth collecting except on the southern and western aspects of the island. Beyond certain limits the bark is never of a good quality, as it is powerfully affected by local circumstances.

The *karuwa* of the Malabar coast has been considered by many botanists as identical with the *laurus cassia*, but it is said that no specific difference can be discovered between the cinnamon-tree of Ceylon and the *karuwa*. The prepared bark of the *karuwa* is, according to good authority, inferior to the best Ceylon cinnamon. It is, however, allowed to be superior to the produce of the cinnamon-tree which is found on the northern and eastern part of the island.

Linnæus, deceived by the appellation of *laurus cassia*, was misled, and ascribes qualities to that tree which it does not possess. The cassia bud of commerce is not the produce of the *laurus cassia*, but is the fleshy hexangular receptacle of the seed of the *laurus cinnamomum*.

When gathered young, the receptacle completely envelopes the embryo seed, which progressively protrudes but continues firmly embraced by the receptacle. The buds are of various sizes, having the appearance of nails with roundish heads. If carefully dried the receptacle is nearly black. These buds are not prepared in Ceylon.

A rather elevated situation is most favourable to the growth of cinnamon; a sandy loam mixed with decayed vegetable matter, is the soil in which it flourishes best. Shelter appears to contribute to its luxuriance, since it grows with unusual vigour near to houses.

When the ground is prepared for planting cinnamon, the low brush-wood and young trees are cut down, but lofty trees are allowed to remain at intervals, as it is found that the tender plants thrive better under their shade than when exposed to the direct rays of the sun. The planting usually takes place when the seeds are ripe. For this purpose a line is stretched across the ground, and guided by it, the planter turns up about a foot square of ground at intervals of six or seven feet. The brush-wood and branches having been previously burnt, their ashes are then spread upon the newly-dug spots,

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and into each of them four or five cinnamon-berries are sown, in holes made with a dibble; they are then covered with earth, and branches of trees are laid over the parts to prevent the earth from becoming parched, and to protect the young shoots so soon as they come forth. This takes place in about fifteen or twenty days. Sometimes the berries are sown in nurseries, and the young plants are transplanted in the months of October and November. In favourable situations, shoots attain the height of five or six feet in about six or seven years, and a healthy bush will then afford two or three shoots fit for peeling. In a good soil, every second year, from four to seven shoots may be cut from one tree, thriving shoots of four years' growth are sometimes fit for cutting. As four or five seeds are usually sown in one spot, and in most seasons the greater part germinate; the plants grow in clusters, "not unlike a hazel-bush." If the season be unusually dry many of the seeds fail, while the want of moisture is often fatal to the young shoots, so that it is sometimes necessary to plant a piece of ground several times successively. A plantation of cinnamon, even on good ground, cannot be expected to make much return until after the lapse of eight or nine years.

This plant is likewise sometimes propagated from shoots cut from large trees, or by layers, or, lastly, by transplanting large stumps. The method of culture by seeds, is considered the least advantageous, as it requires greater attention than other modes, and the trees are longer before they arrive at perfection.

If cultivated from shoots, the sprouts must be continually watered or they will not thrive. Those selected for the purpose should be very young not having more than three leaves; if older, they die.

The third method, by layers, is recommended by Dr. Wright, since the numerous side branches which issue from the bottom of the trunk, always furnish a plentiful supply well adapted for laying.

The transplanting of the old roots is a plan of modern adoption, and the practice is much approved, since they yield

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shoots of the usual size twelve months after they have been placed in the ground. Great care is, however, necessary in their removal, for should any of the rootlets, even of one-tenth of an inch diameter, receive injury, the whole root will certainly perish.*

Thunberg mentions a fifth method of cultivation, or rather a manner of obtaining cinnamon of superior quality. "When the tree is cut down and a fire kindled on the spot to consume the stumps, the roots afterwards throw out a number of long straight shoots which yield incomparably fine cinnamon. From these are cut the cinnamon walking-sticks, which, in appearance, resemble those of the hazel-tree, and retain the taste and smell of cinnamon. They have no scent however, unless when the bark is rubbed."

This tree is now cultivated to a large extent in Ceylon; more than sixteen hundred acres of land are laid out in cinnamon plantations, and the number is annually increasing; one of the largest gardens under this culture, called Marandan, is close to Colombo. "The surface of this land is a pure white sand, under which is a deep stratum of rich mould. In some parts of the island, where this earth is deficient, the trees are barren and not worth cutting. In marshy places also, they thrive no better, but become decrepid, and the bark acquires a bitterness which destroys its sweet and aromatic qualities.†

The cinnamon department gives employment to a vast number of persons in Ceylon; from twenty-five to twenty-six thousand people ‡ being usually engaged in the cultivation of the tree and the preparation of its bark.

The peeling process commences early in May, and continues until late in October. When a *chaliah* perceives a shoot of a proper growth, he strikes an instrument which resembles a small bill-hook, obliquely into the shoot. He then gently opens the gash to discover whether the bark separates freely from the wood, should this not be the case, he leaves the

* Cordiner's Ceylon.

† Ibid.

‡ Sir A. Johnston in Trans. Royal Asiatic Society, vol. i.

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sucker for a future time. Some shoots never arrive at a fit state for decortication. Plants of several years' growth sometimes bear numerous marks of "annual experiments" made for the purpose of ascertaining whether the bark were in a favourable situation for being removed.

The shoots which are cut are usually from a half to three quarters of an inch in diameter, and from three to five feet long.

Some travellers in former times, asserted that the cinnamon was peeled from the tree while standing, and that nature provided the decorticated plant with a new bark. It is said that the experiment has been recently tried on several plants, all of which died in consequence.

The shoots being cut, they are tied in bundles and carried to sheds appropriated to the preparation of the cinnamon. Being cleared of small shoots and leaves, two longitudinal slits are made in the bark, which is gradually loosened with the convex side of the knife, and then, usually, half the circumference of the bark comes off in one entire slip. When the bark adheres firmly to the wood, it is strongly rubbed with the handle of the peeling-knife until it is disengaged and stripped off. The sections of the bark thus obtained, are carefully put one into the other, the outer side of one piece being placed in contact with the inner side of another, they are then collected into bundles and firmly pressed or bound together.

In this state the bark is allowed to remain for twenty-four hours, or sometimes for a longer period; by which means a degree of fermentation is induced that facilitates the subsequent operation of removing the cuticle. After being subjected to this treatment, the interior side of each section of bark is placed upon a convex piece of wood, and the epidermis, together with the greenish pulpy matter immediately under it, is carefully scraped off with a curved knife. This is an operation requiring some nicety, for if any of the outer bark be allowed to remain, it gives an unpleasant bitterness to the cinnamon. In a few hours after the removal of the cuticle, the pieces are put one into the other; the bark dries, con-

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tracts, and gradually acquires the appearance of a quill or pipe, the whole forming a congeries of quills more than a foot in length. During the first day the cinnamon is suspended under shelter upon open platforms, and on the second day it is placed on wicker-work shelves and exposed to the sun. When sufficiently dry it is made up into bundles of about thirty pounds weight each, and these are deposited monthly in the government magazines of Colombo, where, previous to preparing them for shipment, they undergo an examination by experienced native sorters under the superintendence of an European appointed for the purpose.

The bark of large shoots or thick branches of trees produces coarse cinnamon; occasionally the external pellicle of this sort is scraped off, which thins the cinnamon and improves its colour. It is, however, even then, thicker and of a darker colour than that of a good quality, while it is of a very inferior flavour and is disagreeably pungent. This sort is always rejected by the inspectors as unfit to be exported to Europe. The bark of very young and succulent shoots is likewise of an inferior quality and is not admitted among the company's bales. It is very thin and of a light-straw colour, of very little flavour, and that evanescent.

Shoots exposed during growth to the direct rays of the sun, have their bark more acrid and spicy than the bark of those which grow under a shade. A marshy soil rarely produces good cinnamon, its texture, under this circumstance, being coarse-grained and spongy, while it possesses very little aroma.

It is hardly possible to discover the cause which produces the varieties in the quality of the bark, since shoots from the same tree are found to yield cinnamon of very different qualities.

The best Ceylon cinnamon is thin, smooth, and shining, and of a light yellow colour; it admits of a considerable degree of pressure, and bends before it breaks; the fracture is then splintery. It has an agreeable, warm, aromatic flavour, with a slight degree of sweetness. When masticated, the pieces become soft, and seem to melt in the mouth.

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From cinnamon which has been rejected for shipment, oil is usually extracted; the best oil of cinnamon sinks in water, but when inferior it is of smaller specific gravity. A very large quantity of the bark is required for obtaining only a small portion of oil; it is reckoned that 80lbs. of newly prepared cinnamon yield about five and a half ounces of heavy oil, and two and a half ounces light oil.

Cinnamon is packed in bales for exportation, firmly bound round with ropes, and then put into double gunnies. It is the usual custom to send black pepper among the bales; this practice originated with the thrifty Dutch, since by filling up the interstices between the circular packages with peppercorns, tonnage was economised. If there were no pepper, coffee was substituted. Thunberg attributes peculiarly excellent effects to this method of packing with pepper.

CASSIA.—It is very difficult to determine what is the cassia of commerce, which is now so largely imported into this country. It, is, however, most probably the bark of the cinnamon-tree of other countries, and is nothing but an inferior quality of cinnamon. It is well known, that the rejected or third sort of that prepared in Ceylon has been surreptitiously imported into England, and sold under the denomination of cassia.

The subjoined tables exhibit the quantity of cinnamon and cassia imported, exported, and retained for home consumption during the last five years, together with the revenue arising therefrom.

CINNAMON.

	Imported.	Exported.	Consumption.	Revenue.
	lbs.	lbs.	lbs.	£
1827	267,444	359,692	14,451	1,808
1828	337,483	354,536	15,696	1,774
1829	544,225	386,108	29,720	1,342
1830	464,175	535,223	nil.	709
1831	225,869	504,643	23,172	584

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CASSIA.

	Imported.	Exported.	Consumption.	Revenue.
	lbs.	lbs.	lbs.	£
1827	415,702	427,695	42,984	2,123
1828	549,535	356,320	55,787	2,769
1829	817,968	795,242	62,252	2,101
1830	837,589	797,642	65,705	1,624
1831	398,820	718,772	61,162	1,526

The duty on both cinnamon and cassia is now 6*d.* per lb. when brought from British Possession, and 1*s.* on other sorts. This was fixed in 1829; previous to that time, a duty was paid on cinnamon of 2s. 6*d.* for that from British Possessions, and 3*s.* 6*d.* on foreign; and on cassia from all parts, 1*s.* per lb.

The price of cinnamon is, at the present time, exclusive of duty —

	s.	*d.*		*s.*	*d.*	
First sort, from	8	6	to	9	6	per lb.
Second sort ...	6	3	..	7	9	
Third sort ..	4	3	..	5	6	

Price of cassia, 3*l.* 15*s.* to 4*l.* per cwt.

Price of cassia buds, from 3*l.* 10*s.* to 3*l.* 15*s.* per cwt. exclusive of duty, which is the same as on cassia.

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CLOVES.

The clove-tree—*Carophyllata*—a genus belonging to the class and order *polyandria monogynia*.—Nat. Ord. *Hesperidæ*, Linn. *Myrti*, Jussieu.

THIS spice, it is supposed, was well known to the ancients, and certainly formed an article of commerce during the middle ages, when Aleppo was the grand mart of eastern trade.

The country of its production was not, however, ascertained until the discovery of the Molucca islands by the Portuguese, about 300 years ago. Previous to that period it was conveyed to Europe from ports in the Mediterranean, whither it was brought by the Arabians, Persians, and Egyptians.

The Portuguese found the clove-tree growing in abundance at the Moluccas, and first obtained the spice direct from its native soil; but the Dutch did not long allow them to retain this exclusive privilege unmolested, and soon wrested from the original discoverers the reward of their enterprize. The history of this trade would furnish another example of the grasping, monopolizing policy of the Dutch; but this has been already sufficiently noticed in the account of the cinnamon-tree, and it is needless to repeat the same unpleasing story of injustice and oppression. With the desire of keeping the cultivation of the clove-tree completely within their own power, it is said that the new settlers in the Moluccas caused all the clove-trees to be destroyed on every island except Amboyna, where they watched over its careful cultivation, obliging each of the natives to rear a certain number of plants. The more certainly to insure its destruction elsewhere, they paid an annual tribute to the kings of Ter-

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nate, Tidor, and Bantam, to permit and assist in the extirpation of the tree which abounded in the Archipelago of which they were masters. Meanwhile, in the one favoured isle the land was divided into four thousand allotments; each of which divisions was expected to afford sufficient space for the growth of one hundred and twenty-five trees, and it was ordered that this number should always be cultivated. In 1720 a law was passed rendering it compulsory on the natives to make up the full complement. Accordingly, 500,000 clove-trees flourished within the limits of this small island. Their annual produce averaged rather more than two pounds of cloves per tree, making the annual aggregate amount to more than a million of pounds of cloves. The Dutch in vain, however, sought to extirpate the tree from all other parts, and to confine its culture to this spot exclusively. It still flourished in some of the smaller islands which had not yet been visited by the Dutch; from Guebi, one of these, the French obtained the clove and the nutmeg-trees, and successfully transplanted them into the Isle of France. This was effected by M. Poivre in two expeditions made in the years 1769, and 1771; and in 1785 there were already between ten and eleven thousand clove-trees growing in the island. From the Isle of France several plants were conveyed to Cayenne; and in 1789 the culture of the clove was introduced into Dominica. Subsequently plants were obtained at Martinico, whence, in the year 1797, 380 pounds of cloves were imported into London, and in the year following 200 pounds. At St. Kitt's, likewise, the plant was cultivated, and a quantity of its produce imported into England. At a later period some clove-trees were removed from Martinico to St. Vincent's; and in 1800, cloves produced in that island were transmitted to the Society of Arts by Dr. Anderson. Some samples of cloves, as well as nutmegs, have been recently sent home from Trinidad for the approbation of the same society.

The clove-tree is extremely handsome, of a noble height, beautiful form, and luxuriant foliage. It has a thin, smooth bark, enclosing a trunk of exceedingly hard wood. When it has reached to about a foot in height, it spreads into

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THE CLOVE-TREE—(CARYOPHYLLATA).

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several branches; these are furnished with leaves growing opposite to each other, and which are smooth, narrow, pointed, indented round the edges, and of a thick consistence. The colour of the upper surface, and of the footstalk, is inclining to red; that of the under surface is green. The flowers grow in small bunches, upon branched peduncles, at the extremities of the boughs; they are of a delicate peach-blossom colour, and come forth in the rainy season. The calyx is elongated, and forms the seed-vessel. As soon as the corolla begins to fade, the calyx changes its colour first to yellow, and then to red. It, together with the embryo-seed, is at this stage of its growth the clove of commerce. If suffered to remain on the tree after this period, the calyx gradually swells somewhat in the same manner as that of a rose; the seed enlarges, and the pungent properties of the clove are in great part dissipated. In this state it entirely loses its value as a spice, and is then called a mother-clove, which is only valuable as seed for propagating the plant. One seed, which attains to a considerable size, is contained in each calyx. The whole tree is strongly aromatic, and the petioles of the leaves have nearly the same pungency as the calyces of the flowers. The leaves themselves partake strongly of the qualities of the cloves, and do not lose their aroma when dried; they may, therefore, form a good substitute in cookery. The clove-tree is propagated either by seed or layers; if by seed, holes are made from eight to ten feet apart, and a seed is dropped into each hole. On its first vegetation the plant appears like a small, straight, red dart; when it attains to the height of about two inches, two small red leaves shoot forth at the top. If the young branches are laid down, and the ground is kept moist, they usually take root in six months. The plant thrives best on a strong compact soil, whether of a gravelly or clayey nature; a damp situation is decidedly adverse to its growth.

The clove-tree seldom arrives at sufficient maturity for producing fruit till eight or nine years after sowing. In the Moluccas the trees are generally topped and kept within eight or nine feet high, for the greater convenience of gathering the produce; but if left to nature they attain to a much greater

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height. As the cloves become in a fit state they are taken from the tree; if allowed to remain for one gathering alone, a part only would be of any value, and the rest would be either in a too forward or too backward state to be used as spice. At the time of gathering, cloths are spread on the ground, and the cloves are beat down with reeds. They are then placed on hurdles, covered with large leaves, and subjected to the action of smoke; after this fumigation they are dried in the sun, and are then fit for exportation.

A particular account of the culture of the clove-tree at Dominica and St. Vincent will, perhaps, prove more useful than an enlarged description of its culture in the Moluccas; since this will best show how it may be successfully transplanted into other parts of the tropical regions. M. Buée, the first cultivator of the clove-tree in Dominica, obtained for his commencing essay only one young plant about half a foot high, having no more than six or eight leaves. Pursuing the directions received with it, he planted it in rich soil, and in the shade of other trees. It did not, however, thrive, and he had the mortification of seeing it wither and soon die away. He then procured two other plants from Cayenne, and planted these near the house for the convenience of watching them, but the soil here was very poor. Fourteen more plants were subsequently obtained, and M. Buée planted these in various situations and soils. He found that the plant grew with sufficient luxuriance in a sterile soil, composed of a yellowish or reddish stiff clay, such as that in which the pimento flourishes, but which, for the generality of crops, is scarcely fit for cultivation. Sixteen hundred trees were afterwards raised from seed, which, in a year from the first sowing, were transplanted.

The following is the manner in which the cultivation of this plant, was most successfully pursued by M. Buée at Dominica: — The seeds were sown at about six inches apart from each other in beds. Over these beds small frames were erected about three feet from the ground, and plantain-leaves were spread on the top in order to shelter the young plants from the sun. The leaves were allowed gradually to decay

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and, at the end of nine months, the young plants, which by that time were strong, were allowed to receive the benefit of the sun; but if not protected from it when very young, they were found to droop and die.

When transplanted, the trees were placed at sixteen feet apart from each other. They grew very luxuriantly, and at the end of fifteen months after their removal, attained the height of from three to four feet. The ground wherein they were planted had been a coffee plantation during forty years. The coffee-trees had decayed, and an attempt had been made to replace them; but they refused to grow; whereas the clove-plants flourished, as if on congenial soil, and a crop was gathered from some of them when they were not more than six years old, which period is two or three years earlier than the usual time for gathering.

The cloves sent from St. Vincent's to England in 1800 were obtained from trees eight feet high, having a stem only two inches in diameter. Trial was made in this island of the relative growth of the plant on different soils. It grew sickly on land which was not manured; but on land which had received this preparation, it flourished. It should be planted in a situation where it is not exposed to high winds. The manner of collecting the cloves in this island by one or two at a time, as they become fit for gathering, is so extremely tedious, that if so pursued it is scarcely possible this should ever become a profitable branch of commerce. Indeed, it appears from the testimony of persons well acquainted with the subject, that at Trinidad the same objection exists, and that more economy of labour must be used in this respect in the West Indies before the clove cultivation of the West can be brought in any way to compete with that of the East.

The clove is very rich in essential oil, containing a greater proportion than any other plants or parts of plants. Neumann obtained, by distillation, two ounces and two drams from sixteen ounces of cloves. When newly gathered, cloves will yield oil on pressure. It is said that this method is sometimes fraudulently practised; and that cloves, partially

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robbed of their oil, are mixed with others for sale. They are, however, to be detected by their pale colour, shrivelled appearance, and want of pungency. Oil of cloves is of greater specific gravity than water. This oil, combined with the resinous matter of the spice, gives to it all its pungency. The tree may, however, flourish and bear fruit, having these qualities elaborated in a very small degree; and, therefore, the art of the cultivator is required for placing it in the most favourable situation for the developement of its valuable properties. It is supposed that it can be made to flourish only within a very small range of the tropical region. It has indeed been asserted that its successful culture is wholly confined to the Moluccas; but this has been fully disproved.

The plant attracts so much moisture, that no herbage will grow beneath its branches; and the produce, when newly prepared, has so great an affinity to water, that if it be placed in a vessel near to a heap of cloves, they imbibe, in the course of twelve hours, so much humidity as considerably to increase their weight. It is said that their traders in cloves sometimes avail themselves of the knowledge of this fact, in order to give an undue value to their property.

Quantity of Cloves retained for Home Consumption from 1814 to 1818 inclusive, and from 1825 to 1831 inclusive.

	lbs.	
1814	31,975	Duty 5*s*. 7*d*½. per lb.
1815	50,462	
1816	16,470	
1817	73,973	
1818	18,281	
1825	45,261	Duty 2*s*. British plantation. 3*s*. Foreign.
1826	52,701	
1827	85,990	
1828	61,216	
1829	48,637	
1830	60,111	
1831	83,885	

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Quantities imported and exported, with the Revenue arising from the Duty on Cloves, from 1827 to 1831 inclusive.

	Imported.	Exported.	Revenue.
	lbs.	lbs.	£
1827.....	253,009	27,812	8,602
1828.....	484,368	152,687	6,149
1829.....	36,071	57,904	4,876
1830.....	158,006	39,576	6,061
1831.....	128,223	81,912	8,374

The price of cloves in bond at the present time (Nov. 1832) is,

	d.		s.	d.
Amboyna cloves, from	11	to	1	6
Bourbon	8	..		11
Cayenne	11			

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NUTMEG.

The nutmeg-tree — *Myristica Moschata*, a genus of plants belonging to the class *Diœcia*, and order *Syngenesia*, and of the natural order *Lauri*.

This spice is likewise the produce of the Moluccas, and its history is exactly similar to that of the clove. In this case, the more certainly to retain the whole of the trade within their own hands, the Dutch confined the cultivation of the nutmeg-tree to the island of Banda, where a system of oppression was practised on the unfortunate natives, which occasioned almost their total destruction. Even when under the temporary sway of the English,* the same system was pursued, inimical alike to the principles of sound policy and of humanity. Sir Thomas Raffles, writing in 1815, makes the following observations on this subject: —

"Nutmegs, which ought to be as cheap as betel-nuts, and cloves no dearer than pepper, are, by the present system, confined to the consumption of the rich alone. But this is not the main evil: did the unfortunate people, by whose industry these spices are produced, and on whose soil they grow, benefit in any way by this high price, an excuse might be found. But, to the disgrace of humanity, the original inhabitants of these miserable islands are nearly extinct; the wretched remains are in a state of the most abject poverty. The gardens of Banda, where all the nutmegs are produced, are worked by *slaves*, and the public duties carried on throughout by forced services. The inhabitants of these remote

* The East India Company took possession of the Moluccas in 1801—these islands were restored to the Dutch by the Convention of the 13th of August, 1814.

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islands as yet know nothing of British government; and the British government knows still less of its unfortunate and suffering subjects. If, on commercial principles, it may be deemed advisable that these spices shall be collected into few hands, let the gardens or their produce be farmed out. Let the East India Company, or any association of Europeans, enter into the speculation, but let the British government preside."

It proved a vain endeavour to confine the growth of the nutmeg-tree wholly to the island of Banda. It is said that the wood-pigeon, which feeds on the fruit, has often been the means of disseminating the plant beyond the narrow limits to which the selfish policy of man would confine it; and that it has, in consequence, been found growing naturally through a much wider range than the clove.

Forrest ascertained that the nutmeg-tree grew in New Guinea, and thence transplanted it to the Philippine Isles. The French, as already stated, at an early period cultivated the nutmeg as well as the clove in the Isle of France, and thence extended its cultivation to their Western dependency, Cayenne. In Sumatra it has likewise been cultivated with success. We learn from Sir T. Raffles that, in 1820, there was a plantation at Bencoolen of one hundred thousand nutmeg-trees, one-fourth of which were in full bearing. Their growth and produce in this island are equal, in luxuriance and abundance, to those of the Moluccas, but their culture is considered more expensive.

During the short peace of Amiens, the tree was first introduced into the British West Indies, two plants having been then imported from Cayenne to the Island of St. Vincent. One of these plants died, and the other, proving to be a male-tree, it was aided by two others which had been conveyed from India to Trinidad in 1806. These were cultivated successfully, and from this stock plants proceeded. A few of these, when about five years of age, were transplanted into the Botanical Garden at Trinidad in 1820; and, three or four years after, fifty more plants were procured from St. Vincent. Thirty-two out of these were female, or fruit-bearing trees, from which, in the

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summer of 1830, more than twenty pounds of nutmegs were gathered, and transmitted to the Society for the Encouragement of Arts, &c. for their approval. These nutmegs were submitted by the society to the inspection of the most experienced spice merchants, who declared that most of them were equal to the Eastern produce, and would command an equal price in the market: the gold medal of the society was in consequence awarded to the successful cultivator.

It appears that preparations have been made for the cultivation of this plant in Trinidad, on a very extensive scale. Plants have been raised, both from seeds and layers, sufficient to occupy one hundred acres of land. In 1828, thirteen hundred perfect nutmegs were gathered from one of the trees planted in 1820, and in 1830, some of the trees planted in 1824 were equally productive. The persons engaged in the cultivation are sanguine as to its success, and consider it an object every way worthy of the attention of government, "as this cultivation is singularly adapted to the occupation of white persons of all ages and both sexes."

It is computed that each female tree, when at full maturity, will yield, under careful culture, ten pounds of nutmegs and about one pound of mace annually.

The nutmeg-tree is of larger growth than the clove, and has its leaves broader in proportion to their length, the upper surface of these is of a fine-green, the lower of a grey-colour. It is a dicœcious plant, that is, having male or barren flowers upon one tree, and female or fertile flowers upon another. Both are little bell-shaped flowers of a white colour, and without a calyx. The embryo fruit is to be discerned at the bottom of the female flower, in the form of a little reddish knob. The female flowers come forth from the extremities of the branches and grow two or three together upon slender footstalks, but it is seldom that more than one of these is fruitful.

Soon after the fecundation of the embryo, the female flower drops off and the little knob expands, gradually increasing until, at about the end of nine or ten months, it attains to the size and has the appearance of a small peach, somewhat pointed at each end. The outer coat is about half an inch

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NUTMEG—(MYRISTICA MOSCHATA).

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thick and of a rather hard and fibrous substance. When arrived at maturity, this part bursts, and a membraneous covering of a fine red colour is disclosed beneath, which, when dry, is known as the *mace* of commerce; this envelopes a thin black shell which encloses the kernel or nutmeg.

The plant is propagated both by seeds and layers. In the formation of a plantation, the trees should be set from twenty five to thirty feet apart from each other. A strong, rich, and rather moist loam is the soil most favourable to their growth; when planted on a sandy soil they are not nearly so productive. The tree seldom bears fruit till it has attained the age of nine years.

When arrived at maturity, the crop is gathered and divested of its outer covering. The mace, which resembles a leafy network, is then collected and spread in the shade to dry. This is rather a nice operation, and it requires some experience to ascertain the exact point at which the spice is sufficiently desiccated, if too dry, part of the flower exhales, and, being more brittle, it is more liable to break in packing. On the other hand, if it be too little dried, it is apt, when packed, to ferment or to breed worms. It is packed for exportation by being pressed very closely in bags.

The shell of the nutmeg is harder than that of a filbert, and could not be broken when the fruit is first gathered, without injuring the kernel. It is, therefore, first subjected to the action of the sun and then to that of fire heat. The kernel, in consequence of this treatment, shrivels up, which is ascertained by its rattling in the shell. In this state the kernel may be easily divested of its covering without being broken.

Nutmegs are usually soaked in lime and sea-water and then laid in a heap, in which situation they become heated and their moisture is evaporated.

This process is pursued in order to destroy the vegetative power of the kernel, while it is considered to preserve the flavour of the spice. The nutmegs brought from Trinidad were simply dried without immersion in lime-water.

Unless perfectly well cured, nutmegs are liable to be attacked by worms, which, in a short time, multiply so rapidly

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that the whole stock of a warehouse or cargo of a ship, may soon be infected and entirely lost. It is, therefore, highly necessary to examine the nutmegs carefully before packing, in order to separate such as have worms from the rest. This scrutiny is called *garbling*. Those kernels from which the worm has escaped, are readily discovered by the hole which it has made, but it requires some knowledge and an experienced eye to find out the nuts in which the worm is at its destructive work. The base of the nutmeg, where it has been attached to the shell, must be examined; should this be found more than usually depressed, the opposite point will be raised or swelled a little; the outer pellicle will then readily come off by application of the nail, and discover the lurking-place of the enemy.

Nutmegs are divided into two varieties, the royal and the green. The former is of a larger size and has its mace longer than the nut, which, in the latter, is not entirely enveloped by the leafy net-work. Good nutmegs are distinguished by being large, round, and heavy, finely marbled, and of a light-grey colour.

A fixed oil is abundantly obtained by pressure from the broken kernels, a pound of which usually yields about three ounces of oil. The result of Neumann's experiments gives this oil in a much greater proportion, being, according to it, one-third of the weight of the kernel. This oleaginous matter is of the consistence of tallow, of an agreeable smell, and of a yellow colour. It is improperly termed oil of mace, by which name it is known in commerce.

A transparent volatile oil may likewise be obtained by distillation, but only in a very small proportion, being about one thirty-second part by weight of the nutmegs used. This is the nutmeg oil of commerce.

Our principal supply of nutmegs is obtained from the East-India Company's territories and Ceylon, but a large quantity likewise comes to us through Holland. If imported direct from that country they are liable to a duty of 3*s.* 6*d.* per pound when cleared for home consumption, but they are admitted to entry under bond for re-exportation, without payment of duty. This leads to a curious mercantile transac-

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tion. From London, nutmegs are shipped to the Cape of Good Hope, and are thence re-imported into this country. As coming from a British colony they are then only charged with a duty of 2*s.* 6*d.* per pound, and a saving of 7*d.* or 8*d.* per pound is made by this proceeding, as the whole expenses of freight, insurance, &c., from London to the Cape and back again, do not exceed 4*d.* or 5*d.* per pound.

It is reckoned that the present average monthly home consumption of nutmegs, is fifty casks or about 10,000 pounds.

Quantities of Mace retained for Home Consumption, from 1814 to 1818, and from 1825 to 1831 inclusive.

	lbs.	
1814.....	5490	Duty, 9*s.* 2*d.* per lb.
1815.....	7834	
1816.....	6499	
1817.....	8642	
1818.....	10836	
1825.....	14,851	Duty, 3*s.* 6*d.* per lb. Drawback, 3*s.* 2*d.* per lb.
1826.....	15,600	
1827.....	16,760	
1828.....	16,094	
1829.....	14,254	
1830.....	12,600	
1831.....	18,894	

Quantities of Mace imported and exported, and Amount of Revenue arising from the Duty on Mace, from 1827 to 1831 inclusive.

	Imported.	Exported.	Revenue.
	lbs.	lbs.	£
1827.....	23,133	31,768	2,963
1828.....	42,134	37,783	2,829
1829.....	6,841	20,106	2,549
1830.....	15,789	14,596	2,205
1831.....	41,287	63,795	3,266

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Quantities of Nutmegs retained for Home Consumption from 1814 to 1818, and from 1825 to 1831 inclusive.

	lbs.	
1814	43,160	Duty, 5*s.* 5*d.* per lb.
1815	59,839	
1816	54,677	
1817	65,747	
1818	66,255	
1825	99,214	Duty, 2*s.* 6*d.* British possessions. Drawback, 2*s.* 3*d.* Duty, 3*s.* 6*d.* Foreign. Drawback, 3*s.* 2*d.*
1826	101,111	
1827	125,529	
1828	140,002	
1829	113,273	
1830	121,260	
1831	152,369	

Quantities of Nutmegs imported and exported, and the Revenue arising from the Duty, from 1827 to 1831 inclusive.

	Imported.	Exported.	Revenue.
	lbs.	lbs.	£
1827	74,854	35,389	15,707
1828	58,685	32,518	17,514
1829	38,868	47,913	14,114
1830	247,912	163,045	15,158
1831	210,363	88,352	19,025

The price of mace is, at the present time (Nov. 1832), from 4*s.* 9*d.* to 5*s.* 9*d.* per lb. dependent on the quality, and exclusive of duty.

Nutmegs are from 3*s.* 9*d.* to 4*s.* per lb. exclusive of duty.

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PEPPER.

Pepper vine — *Piper nigrum* — belonging to a genus of the class and order *Diandria Trigynia*.

The pepper-plant is indigenous to both the Indian peninsulas. It grows most abundantly on the coast of Malabar, whence pepper forms a considerable export. Java, Sumatra, and Borneo, likewise produce it in large quantities.

The Dutch, with that grasping policy which has always characterized the management of their Eastern possessions, long strove to monopolize the whole of the pepper trade; and, to forward their views, forced its cultivation in Java with an avidity which defeated its own purpose. Sir Stamford Raffles, in his excellent History of Java, observes on this subject, that "Pepper, which at one time formed the principal export from Java, has, for some time, ceased to be cultivated to any considerable extent. It was reared principally in Bantam and the dependencies of that province in the southern part of Sumatra; and, in the flourishing state of the monopoly, these districts furnished the Dutch with the chief supply for the European market. But the system by which it was procured was too oppressive and unprincipled in its nature, and too impolitic in its provisions, to admit of long duration. It was calculated to destroy the energies of the country, and with them the source whence the fruits of the monopoly proceeded. In the year 1811, accordingly, neither Bantam nor its dependencies furnished the European government with a single pound of this article." — Vol. i. p. 131.

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A more enlightened system has, however, for the last few years been pursued with regard to the cultivation of pepper in Java. It is no longer engrossed as a government monopoly, and perfect freedom is allowed in the raising of this production.

When the East India Company first formed a settlement on the coast of Sumatra its attention was directed to procure an extensive growth of pepper. For this end a stipulation was made with some of the native chiefs, binding them to compel their subjects each to cultivate a certain number of pepper vines. The whole of the produce obtained from these plants was to be delivered exclusively to the Company's agents at a price far below what would constitute a proper remuneration for the labour bestowed on its cultivation and preparation.* The authority of the chiefs for a while enforced obedience to this arbitrary measure; and their interest in causing its continuance was supposed to be sufficiently engaged by granting them an allowance proportionate to the quantity of pepper delivered. This gross oppression was, however, too keenly felt to be willingly endured; and accordingly, as the influence of the chiefs declined, the people relaxed in their exertions, and the annual supply fell off, the natives refusing to work on such unjust terms. The chiefs, unable any longer to obtain acquiescence in their despotic behests, abandoned to the agents of the Company the task of obliging the people to labour, that others might reap; and as long as an efficient establishment was kept up, this work of oppression continued successful, inasmuch as the stipulated number of vines were still cultivated, and the usual consignments made to Europe.

Happily the rights of others are now better understood and respected, and the impolicy, as well as the injustice of such measures, are fully acknowledged. The pepper of Su-

* The price which was for many years paid to the cultivators of pepper, was ten Spanish dollars, or fifty shillings, per bahar (5 cwt.) About 1780 the price was augmented to fifteen dollars. Duty in addition paid to the chiefs was from one and a half to two dollars per bahar. This low price afforded to each cultivator an income of not more than from eight to twelve dollars.—Marsden's Sumatra.

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PEPPER — (PIPER NIGRUM).

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matra is no longer obtained by oppressing the natives, and its cultivation is declared free.

The cultivation of the pepper plant has been successfully pursued in the Western hemisphere. We learn, from "La Guiane Française" of 5th February, 1825, that it was a few years since introduced at Cayenne, and followed up with uncommon perseverance by General Bernard. Commenting on this circumstance, the writer in the publication just named, remarks, "The results give reason to hope that the time is not very far distant when France will be delivered from the tribute which she pays to foreigners for the supply of this spice. More than thirty thousand pepper-trees are about to enter into bearing on the estate of the estimable settler whose efforts we admire; and each pepper-tree promises to furnish for exportation from four to five kilogrammes of pepper."

The berries of the *piper nigrum* are the black and white pepper of commerce. This is a perennial plant, with a creeping or climbing stem of a dark colour, which soon becomes ligneous, and acquires considerable thickness. The leaves are heart-shaped and pointed, with a glossy surface, and of a dark green colour. They have very little smell or pungency. The branches are short and brittle, not projecting above two feet from the stem, and separating readily at the joints. Clusters of small white flowers are succeeded by round berries, green when young, and turning to a bright red as they arrive at maturity. They grow abundantly upon all the branches, from which they hang in large bunches, resembling, in form, clusters of grapes; but the berries grow distinct, and more in the manner of currants or elder-berries.

This plant thrives luxuriantly in most soils, and, when once reared, requires comparatively little care and labour. The preference, in choosing a situation, is usually given to level grounds along the banks of rivers (provided they are not so low as to be inundated), on account of the rich vegetable mould found in those localities, and for the advantage of water carriage. Plantations of this tree are seldom made on rising ground, unless the ascent be very gentle; otherwise the soil is liable to be loosened and washed away from the roots

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of the vines. The goodness of pepper is considered to depend more upon the natural qualities of the soil than upon the care bestowed on its cultivation. It is a hardy tropical plant, and grows readily from cuttings or layers, rising in several knotted stems, which cling round any neighbouring support, and adhere to it by means of fibres that shoot from every joint at intervals of from six to ten inches, and through which it probably imbibes its nourishment. If left without any means of climbing upwards, the stalk, unable to support itself, creeps along the ground. The fibres at the joints then become roots, but in this situation "the plant would never exhibit signs of fructification."*

Like ivy, it is encouraged by support to throw out bearing shoots. If left in its natural state it climbs to twenty or five-and-twenty feet high; but it is more fruitful when not allowed to attain this height. Restrained in its growth, to from twelve to fifteen feet high, it bears both foliage and flowers within a foot of the ground; but in the former case, the lower part of the stem is entirely devoid of these.

In order to give to the pepper-vines the support they require, it is usual to plant some other trees with them for that purpose. The Jacca tree — (*Artocarpus integrifolia*) — is selected in Malabar thus to lend its support, since the same soil is equally well adapted to the growth of both plants. In Sumatra a thorny tree, called by the natives chingkariang (*erythrina corallodendron*) is employed. In Borneo the vines are supported, like hops, by poles; but there is a great disadvantage attendant on this method, as the poles thus exposed decay at the end of two or three years, while the plants last many years, and they are much injured in the removal of the old poles, and the placing of new ones. Besides this, the use of poles has another disadvantage in the absence of foliage, which, during the dry season, is of service in sheltering the vines from the too ardent rays of the sun.

When a piece of ground is to be converted into a pepper plantation, it is marked out by means of a line into regular

* Marsden's Sumatra.

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squares, having their sides about six feet, the intervals at which the plants are intended to be placed from each other. The points of intersection are noted by slight stakes, and at each of these points a tree intended for the prop is planted; for this purpose cuttings of about two feet long are put into the ground a span deep; sometimes cuttings six feet long are used, but these often fail, are not so vigorous as shorter ones, and generally grow crooked.

When the shoots of the chinkariang are twelve or fifteen feet high, a height they usually attain during the second year of their growth, they are topped, and not allowed to grow much beyond this altitude. The branches are lopped annually at the commencement of the rainy season in November, leaving little more than the stem, or otherwise the droppings from the leaves might injure the vines.

The usual mode of propagating the pepper-plant, is by cuttings of a foot or two in length taken from the horizontal shoots, which spring forth from the foot of the old vines. One or two of these cuttings are planted close to the young chinkariang-tree, sometimes as soon as the latter has taken root, but oftener after a lapse of six months from its first being planted —a few cultivators allow an interval of twelve months, fearful lest the growing vine should overpower its support; but in general, if this be a healthy and vigorous shoot, so long a period of priority is unnecessary for its thriving, as it advances in strength and growth in proportion as the vine requires its sustaining power. The vine rises about two feet in the first year, and four or five more in the second; at this time, or between the second and third year of its growth, it first begins to put forth blossoms. In the rainy season which succeeds this first promise of fruit, the entwining stem is uncoiled from its support, and placed in a spiral form into a hole dug in the ground for the purpose, close to its root, leaving only the top of the plant above ground; it soon re-ascends the chinkariang-tree with renewed vigour, and in the ensuing season the plant, then eight or ten feet high, usually bears a full crop of fruit. If this operation be performed too soon, the vines will not be forwarder than those newly planted,

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and will not bear fruit until the third year. On the other hand, if delayed beyond the proper time for the sake of saving the first fruit, the produce is ultimately retarded, although the desire of a present good, in preference to a future greater advantage sometimes incites the cultivator to adopt this plan, and to omit turning his plants down until he has gathered in a premature harvest. During three or four years after the first crop, the produce annually increases; a plantation of about seven or eight years growth, is then in its prime; it continues in this flourishing state from one to four years longer, according to the fitness of the soil, and then gradually declines for about the same period, till it is no longer worth the labour of keeping it in order. Fruit has been gathered from some plants of twenty years' growth, but that is a very uncommon circumstance. As soon as there is any appearance of decline in the crop, the plantation should be renewed, or rather another garden should have been planted to succeed it, so that it may come into full bearing at the time required. The vines sometimes grow bushy at top, when they must be pruned or thinned by hand; the flexile stems generally entwine to the top of their support, and then bend downwards, having their extremities, as well as their branches, loaded with fruit. In the early growth of the plant it is immaterial how many stalks grow to one root; but when it begins bearing fruit, then only one or two stems should be suffered to rise and cling to the prop; more would weaken the root, and cause it not to bear so abundantly. All suckers and side-shoots must be carefully removed. Some which are healthy and of vigorous growth are usefully employed; trenches are cut to the neighbouring props where the vines have failed, through these the superfluous shoots are conducted, and thence soon ascend round the adjacent tree; otherwise they are at once separated from the parent root, and transplanted to other spots; by which means the plantation is of uniform growth, though many original vines may not have succeeded. These shoots may likewise go to the formation of new gardens.

The ground is always kept well weeded. During June, July, and August, the finer kind of grass is permitted to re-

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main on the ground as a protection against the rays of the sun, and as the means of preserving and attracting the dews, which are then heavy. As the vines increase in size, less care is necessary in clearing the ground, since the shade prevents the weeds from growing.

Plantations are divided into gardens containing from five hundred to one thousand plants. Industrious or opulent cultivators have sometimes gardens containing as many as two or three thousand vines. These gardens are commonly separated from each other by hedges of shrubs, and have an open border of twelve feet wide round every garden. The gardens are kept with scrupulous neatness: "no rubbish, not so much as a stick or a straw, is to be found on the ground." Their symmetry and neatness give to them an appearance of beauty, although this very symmetry deprives them of the picturesque appearance admired by lovers of nature. Should the season happen to be dry, the cultivators are indefatigable in giving to their plants the necessary moisture; nearly their whole subsistence depending on the success of their crop. In very dry weather the blossoms are liable to fall untimely, or to be shaken off by high winds, in which cases the crop fails. To guard against this latter accident, the gardens are usually placed in a sheltered situation. Long continued drought arrests the progress of vegetation, but does not destroy it. We learn in Marsden's History of Sumatra, that in 1775 there were eight months of continued drought; no foliage appeared on the pepper-plants, and their general destruction was expected; but when the rain at length came, the blossoms appeared in a profusion unknown before. Old gardens which had been unprolific for one or two years, then put forth flowers and bore fruit, so that the crop of 1776-7 was unusually abundant.

The customary time for gathering the principal crop is in September and October, another smaller crop is obtained in March and April. Sometimes the gathering continues at intervals the whole year round; sometimes only one crop is taken, the growth being irregular and dependent on the season. From the first appearance of the blossoms, a period

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of four months elapses before the berries arrive at maturity. But the blooming is not simultaneous, and there are to be seen, growing together on the same vine, clusters of flowers, green fruit, and berries already in a fit state for gathering. As soon as any of the berries begin to redden, and it is thought a favourable time for collecting them, they should be plucked, for if delayed too long they fall off. The natives make use of small triangular ladders made of bamboo, with which they go round the tree and reach all the fruit, which is collected in small baskets slung over the shoulder of the gatherer. It is then conveyed by women and children to a smooth level spot of clean hard ground, and there spread on mats to dry in the sun. The vicissitudes of the weather are not thought to injure it in this stage. As it dries it is occasionally rubbed with the hand to separate the stalks from the berries, which soon become black and shrivelled, and assume the well known appearance of the black pepper of commerce. When dry, they are winnowed in large round shallow sieves, and put under shelter into vessels made of bark, until all the crop is gathered in and dried, or until there is a sufficient quantity to be carried to the factory. That gathered in the properest stage of maturity will shrivel the least; if taken off the tree too soon, it will, after being dried, quickly become mere dust.

The pepper at Borneo, is classed into three different qualities. The Molucca, which is the best; the Caytongee, which is an intermediate sort; and the Negaree, which is of the worst quality, and of which the greatest quantity is obtained. This is a small hollow, light pepper, generally full of dust, and if the purchaser incautiously procures his pepper by measure instead of weight, it is said the native dealers generally contrive to substitute this for their heavy Molucca berries.

The white pepper, which is sold at an advanced price, was, for a long time, supposed to be the berries of another plant; it is now, however, pretty well ascertained that this is merely the black pepper decorticated either from accidental circumstances, or by a process to which it is subjected for the purpose. The first is called genuine, the other factitious white

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pepper. The manner in which the first is obtained, is thus described in Salmon's Modern History, vol. ii. p. 128.

"I do not find any traveller who pretends to have seen it (white pepper) growing. Our merchants tell us that the poor people bring it to them in small quantities, having picked it off the ground, and they apprehend that a small bird called ballaree, feeding on black pepper, digests nothing but the outward husks, and the rest having passed whole through the body of the bird, acquires whiteness. Now, if I may be allowed to give my thoughts of the matter, where the facts are uncertainly transmitted to us, I believe it may be true that this pepper is picked up by the poor people under the black pepper trees; but, as to the birds swallowing and voiding it whole, I must desire to be excused if I do not assent to it; for it seems much more probable that this is the best of the fruit which drops by itself, and by lying exposed to the weather becomes of a whitish colour, and the reason why this is so much dearer than the other is, because it is really the best fruit, and has the fire taken out of it by lying on the ground, but chiefly because there is so very little of it to be had."

The factitious white pepper is made by steeping the ripest red grains in running water, or in pits made near the banks of rivers or in stagnant pools, sometimes it is only buried in the ground. It swells in consequence of this treatment, and in little more than a week, bursts the outer husk, of which it is then divested by being dried in the sun, rubbed between the hands and winnowed. The real goodness of the pepper is in fact, not improved by this process, the water injures its strength, while the outer husk of which it is deprived, contains more aroma than the inner part, but it is reduced to powder more readily in consequence, and presents a more uniform appearance than the ground black pepper.

The pepper-plant when in full bearing is very prolific, the bunches commonly contain as many as twenty or thirty berries in each, and sometimes one vine will yield as much as six or seven pounds of pepper, this is, however, an uncommon case, and the general average of produce is very far below

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this quantity. Mr. Crisp made observations on the crops obtained from the pepper gardens of Sumatra, during twelve years. At the end of that time (1777), taking the average produce of the whole number of bearing vines, he found the annual produce of 1000 vines was 453 pounds: from other calculations, the mean annual produce of the same number of vines is given as being 404 pounds.*

Pepper yields a green-coloured matter by distillation, this is found by analysis to be partly resinous and partly oily, the pungent properties of the berry reside in this mixed product.†

Quantities of Pepper retained for Home Consumption from 1821 to 1831 inclusive.

	lbs.	
1821	1,256,532	Duty, 2*s.* 6*d.* per lb.
1822	1,446,400	
1823	1,368,983	
1824	1,447,030	
1825	850,087	
1826	2,529,027	1*s.* British plantation
1827	1,949,931	
1828	1,927,718	1*s.* 2*d.* East India.
1829	1,933,641	1*s.* 6*d.* other sorts.
1830	2,009,154	
1831	2,050,082	

Quantities of Pepper imported, exported, and Revenue obtained from the Duty on Pepper from 1827 to 1831 inclusive.

	Imported.	Exported.	Revenue.
	lbs.	lbs.	£
1827	9,083,605	4,092,386	97,496
1828	4,987,630	4,226,031	96,468
1829	2,015,184	2,962,063	96,726
1830	2,816,598	1,488,238	100,492
1831	6,273,480	6,844,616	102,639

Price of pepper at the present time (Nov. 1832)—
White, from 5½*d.* to 9*d.* per lb.
Black, from 3½*d.* to 4½*d.*

* Marsden's Sumatra. † Thomson's Chemistry.

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GINGER.

Amomum Zingiber — a genus of the *Monandria monogynia* class and order. Nat. order, *Scitamineæ.*

GINGER is much more extended as regards the countries of its growth than the spices already described. It is a native of the south-east of Asia and the adjacent isles, and is found growing in great plenty on the coast of Malabar. It is conjectured that ginger was known to the ancients, but it is matter of dispute whether the *amomum* which Pliny describes as being brought from Arabia, is identical with the ginger of modern times. Some writers affirm that this plant is indigenous to America; indeed it is recorded that Pinzon, the discoverer of Brazil, brought home, on his first voyage, cinnamon and ginger from thence, thus apparently establishing without a doubt, that these were native to the western hemisphere.* On the other hand, it is stated by other authorities, that ginger was early naturalized in America from the East, but that it was not found there by the first settlers. According to Acosta, it was first transplanted into New Spain from Malabar, by one Francisco de Mendoza, and its cultivation was so quickly extended, that as early as the year 1547, twenty-two thousand and fifty-three hundred weight were exported thence to Europe. Ginger soon became an article of extensive commerce in the West-India islands, especially in Jamaica. The

* Southey likewise adds in a note, "Vieyra in his letters mentions a received tradition that Emanuel ordered all the spice plants to be rooted up, lest the Indian trade should be injured, and that ginger was the only spice which escaped, because it was under ground. He does not appear to have recollected the impossibility of carrying such an order into effect upon a continent." — Southey's History of Brazil, vol. i. p. 32.

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latter place alone exported, in 1738, twenty thousand nine hundred and thirty-three bags of one hundred weight each, and eight thousand eight hundred and sixty-four pounds in casks. This branch of commerce did not, however, long continue to be thus extensive, as when Edwards wrote, at the close of the last century, the average quantity exported annually from the whole of the West-Indies, was only ten thousand bags, and the average importation into England for the last two or three years, has been only 2,453 cwt. from the West, and 7,064 cwt. from the East-Indies. The ginger obtained from the British colonies of the west is of a superior quality to that from the east, and we therefore import the larger proportion from those places. In 1830, 1,268 cwt. were imported into this country from the East, and 4,105 cwt. from the West-Indies.

Ginger is distinguished into several species: the narrow-leaved, the broad-leaved, the Japanese and the red-leaved.

The narrow-leaved is the best known and most esteemed. It has a perennial root and annual stems. The roots are knotty and creeping, extending and increasing under ground in joints, from each of which a slender stem shoots forth in the spring of the year, attaining to the height of from two feet to two feet and a half. The stem, like the reed, is embraced by successive leaves growing opposite to each other, gradually diverging from the plant as they grow up, till they become nearly horizontal; they are lanceolate and about seven or eight inches in length. The flowers stand on a distinct stalk growing out from the root, about a foot high. This stalk terminates in a scaly spike, from each of which scales a single blue flower appears. The whole plant has an agreeable fragrance. The root, taken up when arrived at maturity, that is, just after the annual stalks are withered, is the ginger of commerce.

This plant is cultivated with little trouble in tropical regions, very much in the same manner as potatoes are propagated in England.

After the ground has been well cleansed and trenched, the planting commences in March or April. Holes are made

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GINGER—(AMOMUM ZINGIBER).

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about four inches deep and six inches asunder, into each of which a small piece of the root is put and then covered over with earth. In a few months the whole ground will be overspread with the plant. The stalks begin to wither in the January or February following, and then the roots are in a fit state for being dug up. A sandy soil, and land not having been previously cultivated, are unfavourable to this crop, but under propitious circumstances, ginger yields a very large return.

The ginger of commerce is distinguished into black and white, but both are the same root, and their dissimilarity arises only from a difference in the mode of management. In preparing the black description, the roots, after being divested of their fibril stalks, either by means of a knife or by the hand, are washed in pure water, and then put, about one hundred pounds at a time, in a basket. This basket is then placed in a cauldron of water, and boiled for a quarter of an hour. After undergoing this process, the ginger is merely dried in the sun, and is then in a fit state for exportation. All the dark-coloured external part of the root is scraped off in preparing the white ginger, and the inner part is carefully dried without having been previously subjected to scalding. The best and soundest roots are always selected for this purpose, and therefore, independent of the manner of preparation, the white ginger is superior to the black. It is sold at a much higher price and is every way preferable. Good ginger is distinguishable by being hard and not easily broken, and by having the yellow hue within rather more inclining to green than to brown.

The roots are fibrous when arrived at maturity, but just before they have begun to put out any portion of the stem they are succulent. In this state, or when the young stalks are not more than five or six inches long, the roots are used for making the well known preserve of ginger. When intended for this purpose, as soon as the young tubers are dug up, they are scalded, washed in cold water, and then entirely peeled. This operation requires three or four days for its completion, the water being frequently changed during that time. The roots

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being cleansed, are now placed in jars and covered with a weak syrup, in which they are allowed to remain for two days, at the end of which period this is poured off and replaced by a stronger syrup. This operation is repeated two or three times, at each time the syrup being made stronger, until it becomes of a rich and thick consistency, and the ginger appears bright and nearly transparent. The removed syrups are not wasted; these are made into a pleasant beverage which is known in the West-Indies under the name of "cool drink."

Quantities of Ginger imported, exported, and retained for Home Consumption, from the year 1827 to 1831 inclusive; together with the Amount of Revenue obtained.

	Imported.	Exported.	Consumption.	Revenue.
	cwt.	cwt.	cwt.	£
1827	12,253	6,504	12,383	7,121
1828	14,600	6,930	7,374	4,335
1829	11,007	11,209	5,947	3,403
1830	5,491	4,515	6,284	3,560
1831	5,315	6,092	4,816	2,800

Rate of duty — British plantation, 11*s.* 6*d.*, Drawback, 10*s.* Foreign, 53*s.* per cwt.

Present price of ginger—

	£.	s.		£.	d.	
Bengal, in bond, from ..	2	8	to	2	10	per cwt.
Malabar ditto	2	10	..	2	12	
White Jamaica, duty paid	6	0	..	14	0	
Barbadoes	3	15	..	4	5	

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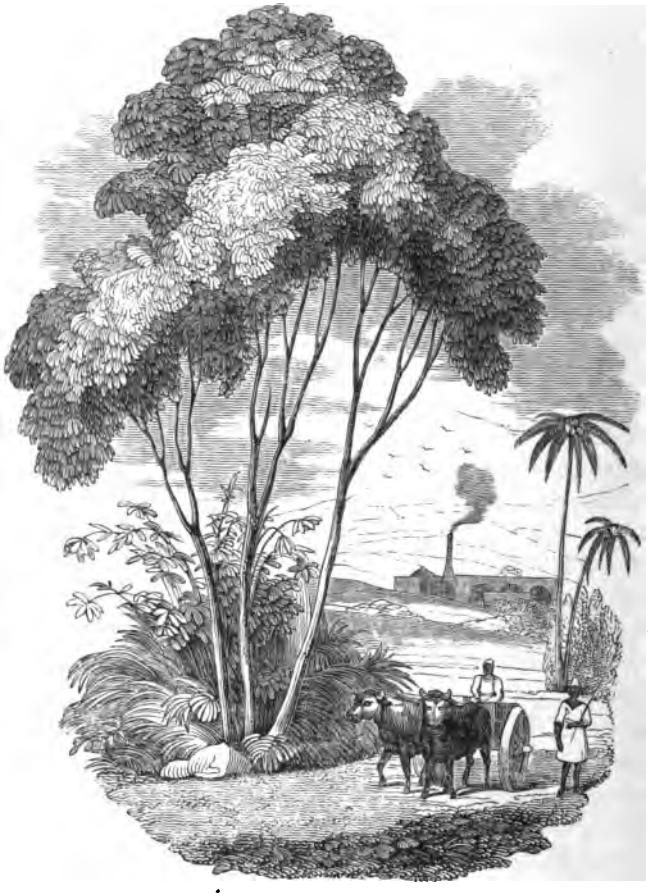

PIMENTO — (MYRTUS PIMENTA).

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PIMENTO.

Myrtus Pimenta — class and order *Icosandria Monogynia.*

THE pimento-tree is a native of the western hemisphere, and is found growing in South America and the West Indies, more particularly in the Island of Jamaica, on the northern side of which it flourishes spontaneously in great abundance.

It is a very handsome tree, rising to about the height of thirty feet. The smooth brown trunk is about five or six inches in diameter, and from this, branches spread on all sides. These branches are garnished with a profusion of smooth shining leaves, of a deep-green colour, and of several sizes, the largest of which are four or five inches long and two or three broad in the middle, whence they decrease to both extremes, ending in a point and standing on petioles of about an inch in length. The flowers appear in July and August, and grow in clusters from numerous foot-stalks about two inches long; they are provided with many greenish-white stamina, standing within four very small petals reflected downwards, and these are succeeded by berries, which are the pimento of commerce. When unripe, they are of a greenish hue, but when arrived at maturity are black, smooth, and shining, containing two seeds embedded in a soft pulp.

The numerous white blossoms mixing with the dark foliage assist in giving to this tree a beautiful appearance, which is rarely equalled in the vegetable world. It is rich in fragrance, which is diffused far around; the slightest breeze that agitates the branches conveys the grateful odour. Nothing, it is said, can be more delicious than the perfume of the walks in which the trees are planted, particularly when they are in blossom.

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The bruised leaf emits a fine aromatic odour nearly as powerful as that of the spice itself.

This tree flourishes on barren land where little else would grow, and though apparently of easy cultivation, is yet mostly confined to certain localities, and a plantation will rarely succeed, except in those parts where it has been found in its native state. Buée gives a remarkable instance of the growth of a pimento-tree, under apparently the most unfavourable circumstances and in a soil where little else would have grown. "A pimento-tree," says he, "which I left growing as a curiosity, and which is from thirty to forty feet and exceedingly straight, stands on the ridge of a rock, which is about twenty-feet in circumference and is near eight feet above the surface of the ground, and pointed at the top; on this top stands the body of the tree, from the trunk of which the roots, encompassing the whole circumference of the rock, go down to the earth whence the tree receives its nutrition."

In the formation of a plantation no regular sowing of seeds or planting of shoots is requisite. The mode usually practised in Jamaica is to select a piece of ground in the vicinity of another plantation, or in an hitherto uncultivated district where the plant is of spontaneous production. All other species of trees which are growing on the land, except the pimento-trees, are then cut down and left in the places where they fall, to decay and parish there. In the course of a year, young pimento plants are found growing on all parts of the land. These, it is supposed, are produced through the agency of birds which scatter the seeds around. The ground is left untouched during another year, when it is thoroughly cleared, only those plants being left which give evidence of vigour and health. In about seven years from the first clearing of the ground the trees come to maturity.

The berries are collected soon after the falling of the blossom; if allowed to ripen, they lose their pungency and peculiar aroma, and acquire a less pleasing flavour, somewhat resembling that of the juniper. Care is therefore taken that few, or none, of the berries be allowed to ripen. It is impossible, however, to prevent some of the ripe berries from being mixed

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with the rest; but if the proportion of them be great, the value of the commodity is considerably injured.

When in a proper state for gathering, a person climbing the tree breaks off the small bunches of fruit; these are transferred to other pickers, generally women and children, who take off the berries from the stalks. Usually the man on the tree thus furnishes a supply, which gives full employment for three pair of hands. An industrious picker will fill a bag of seventy pounds in the day.

As soon as the berries are gathered, they are laid on cloths, spread out on terraced floors under the influence of the sun for about seven or eight days. During the first and second days they are often turned, and afterwards, when they begin to dry, frequently winnowed; they are covered with cloths to preserve them from rain and dew, still being exposed to the action of the sun every day, and removed under shelter every evening until sufficiently dry. In about twelve days they usually arrive at this state, which is known by the darkness of their colour and the rattling of their seeds. At this period they have assumed a wrinkled appearance, and are of a very dark brown hue. After being thus made sufficiently dry, without undergoing any other process, they are stowed in bags or casks, and are ready for exportation.

It is reckoned that they lose a third of their weight in the process of desiccation.

Some planters use artificial heat, and employ kilns in the drying of the berries. This appears the most eligible method, when from abundance of the crop, dispatch, and security against rain are very essential. The berries are esteemed good in proportion to their odoriferous qualities, the smallest are generally the best.

The produce of a pimento plantation is very dependent on the season; at times the crop is extremely abundant, but this rarely occurs above once in five years. Edwards states that a single tree, under favourable circumstances, has been known to yield one hundred and fifty pounds of the raw fruit, or one hundred weight of the dried spice.

From pimento, distilled with water, a delicate odoriferous

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essential oil is obtained. Like oil of cloves it is of greater specific gravity than water, and resembles it so much in other respects, that it is said, when coloured with alkanet root, this oil is sold all over Europe as that of cloves.

Quantities of Pimento imported, exported, and retained for Home Consumption; together with the amount of Revenue arising from the Import Duty, from 1827 to 1831 inclusive.

	Imports.	Exports.	Consumption.	Revenue.
	lbs.	lbs.	lbs.	£
1827	2,235,350	2,005,252	319,667	6,619
1828	2,269,545	1,677,922	310,182	6,459
1829	3,599,268	2,732,493	339,013	7,064
1830	3,528,104	2,262,951	348,525	7,249
1831	1,810,616	1,815,537	304,400	6,375

The price of pimento at the present time is from 4½*d.* to 5½*d.* per lb. exclusive of duty, which is 5*d.* per lb. on that coming from British possessions; other sorts are charged 1*s.* 3*d.* duty per lb.

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CARDAMOM—(ELELBARIA CARDAMOMUM,)

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CARDAMOM SEEDS.

Lesser *Elelbaria Cardamomum:* class and order, *Monandria Monogynia*—Natural order, *Scitamineæ.*

THIS plant has thick, fleshy, perennial roots, resembling those of the large flag iris. In the spring they send forth many green reed-like stalks which rise to the height of three or four feet. These are furnished with very long narrow leaves, placed alternately, and embracing the stalk at their bases. The stalks are annual, withering away entirely in autumn, new ones shooting forth from the roots in spring.

The capsules are divided internally into three cells, in each of which are contained two rows of triangular seeds, brownish on the outside and white within. These pods are collected as they come to maturity, and after being carefully dried in the sun are fit for use. In this state they are exported, as the aroma of the seeds is much better preserved thus, than when they are transported divested of the pod.

This plant is a native of India, Cochin China, China and Ceylon. The best cardamoms are brought from the Malabar coast. In Java the plant grows wild in the woods, but its produce is much inferior to the cardamoms of Malabar.

This plant, until very lately, has been confounded with the *amomum cardamomum,* a native of Sumatra, and other islands to the east of the Bay of Bengal, the seeds of which have the same taste and virtue as the foregoing, but in an inferior degree; and botanists have discovered sufficient difference in the plants to rank them under different genera.

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In the evidence of T. H. Baber, Esq. given before the Lords' Committee in 1830, we find a curious account of the manner in which these plants are produced (it cannot be said cultivated) in Malabar. In the recesses of the mountains, the trees being felled and afterwards burnt, wherever the ashes fall in the openings or fissures of the rocks, the cardamom-plant naturally springs up. In Soonda, Balagat, and other places where cardamoms are made an object of cultivation, the seed is very inferior to that produced in the above manner. When cultivated, they are propagated by cuttings from the roots; in the third year the plants come to perfection, bear prolifically for a year or two, and then die. In some parts of Malabar, however, the spontaneous growth is so abundant as to leave little necessity for cultivation. It was discovered by M. Sonnerat, growing so plentifully on one mountain, on the coast of Malabar, as to furnish sufficient supply for the demand of all India. These seeds are much esteemed in the east for their aromatic quality, as well as a medicinal drug. The usual crop collected in Malabar is reckoned at about a hundred candies annually.* The quality of the seeds varies very much, according to the locality of the plant; they are therefore usually distinguished by the places of their growth, and are esteemed accordingly. Many merchants, by looking at cardamoms, immediately know the part of the country whence they come.

The indications of good seed are — a difficulty of being broken, a plump appearance, a bright yellow colour, and a penetrating odour, with an acrid, and somewhat bitter, though not very unpleasant taste.

Before packing them for sale, great care should be taken that they are perfectly dry. It is considered that they are best preserved in a body. They are, therefore, usually packed in large chests, well jointed and pitched at the seams, and otherwise secured against the admission of any external moisture, as the least damp very much lessens their value.

The trade in cardamoms at Malabar is a monopoly of the

* A candy is 600 lbs. avoirdupois.

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East India Company. The growers of the plant are compelled to sell all their produce to the agents of government at prices fixed by the latter, varying from 550* to 700 rupees the candy, of 600 lbs. avoirdupois. It is stated by Mr. Baber that the contractor often affixes to the coins, with which he pays the mountaineers, an arbitrary and enhanced value, or otherwise compels them to take, in exchange for their produce, other commodities, such as tobacco, salt, oil, betel-nuts, &c., estimating these at prices no doubt far above their market value.

The seeds of the greater cardamom — *amomum granum paradisi* — are sometimes imported into this country from Ceylon, Java, and other parts of the east. They are however but little esteemed. These seeds are imported without the husks; they are angular in shape, of a reddish-brown colour, some approaching nearly to black; they have a thick pellicle, and are about the size of radish-seeds; their smell is less acrid and their taste more nauseous than the Malabar cardamoms, which they do not in the least resemble.

The price of cardamom-seed on the Malabar coast at the places of exportation, varies from 800 to 1200 rupees the candy. The present price in England is from 3*s.* to 3*s.* 4*d.* per pound, exclusive of duty, which is 1*s.* per pound on importation. Cardamoms coming from Ceylon are from 1*s.* 6*d.* to 1*s.* 10*d.* per pound.

* A rupee is nominally 2*s.* 6*d.* value, but its real worth is at present about 2*s.*

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INDIGO.

Indigofera — a genus belonging to the class and order *Decandria Diadelphia* — natural order *Papilionaceæ.*

INDIGO, under the name of *indicum*, has been known as a production of India, from the period when the rich merchandize of the East first found a passage from that remote country into Europe.

The tedious and circuitous land journey by which these oriental luxuries were long obtained, rendered them of necessity scarce and costly, while a veil of mystery hung over their nature and the manner of their production. Accordingly, we find *indicum* mentioned by several ancient writers as a pigment too precious to be used by any but the rich, while various conjectures were indulged as to its formation. Pliny supposed it to be the exudation from a certain reed mixed with mud, and Dioscorides considered it to be a stone; nor could any certain information be obtained of its nature until it was received direct from the country of its production: and a long period even after this elapsed, before its origin was sufficiently known for it to be generally considered as a vegetable production.

Beckmann mentions that in the letters patent granted to the proprietors of mines in the principality of Halberdstadt, indigo was classed among the *minerals*, on account of which the works were permitted to be erected.

This ignorance of the manner of producing *indicum* among the ancients did not, however, extend to its properties, which are so accurately described by Pliny as to leave no doubt that the *indicum* of the ancients was identical with the indigo

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of the moderns. In every age there are traces of its having been known in Europe. It was, however, used only as a pigment until about the middle of the fifteenth century, at which time the Dutch imported it in sufficient quantities to be applied to the purposes of dyeing. A species of the same plant was soon after this time recognized growing spontaneously in Brazil, and a die was prepared from it by the Portuguese settlers.

It was, however, a long time before the prejudices of the different European governments, kept alive by the particular interests of the few, would countenance the use of this substance, its colouring matter being supposed to be pernicious, or at best but fugitive. Many were the restrictions by which its introduction was sought to be prevented in different countries; notwithstanding which, the importation of indigo into Europe was considerable, even in the beginning of the seventeenth century. In Germany the opposition to its introduction was very great, and prohibitions against its use were rigorously enforced. The use of indigo was likewise forbidden in France from 1596 to 1669, when Colbert, the enlightened minister of Louis XIV., had the good sense to repeal all prohibitory edicts existing against this valuable dye. It was only by very slow degrees, however, that it obtained favour in England, and the prejudice against its use, yielding to the hand of time, its importance as a dye has been, at length, fully recognized.

As the consumption of Indigo increased in Europe, the Indian cultivator found rivals in the planters of the Western hemisphere. The die imported from America soon became of so superior a quality, that the indigo from India was, in consequence, depreciated in value, and was brought thence in but very small quantities, since it could only be disposed of at inadequate prices. The superiority of the American produce, over that of India, however, arose entirely from the manner of its preparation, since the plant most extensively cultivated in America, was originally brought from the East. From this circumstance of the *indigofera tinctoria* having been transplanted to the West, several writers, among whom is the Abbé

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Raynal, have been induced to conclude that indigo is not indigenous to America. Some species of this plant are, however, natural to all the tropical regions of both hemispheres, being alike indigenous to Asia, Africa, and America. Columbus found a species of *indigofera* at Hispaniola (Hayti) on his first discovery of that island. The writer has himself seen the plant growing wild in one of our smaller West India islands, where there is no recollection of its ever having been cultivated. This plant likewise grew abundantly in Mexico, where the native Aztecs were acquainted with its use for the production of a beautiful die.

It was formerly cultivated in South Carolina; and, though not so productive there as in tropical regions, its culture was considered sufficiently advantageous to be pursued to a great extent, until the increased produce, in countries more favourable to the growth of the plant, caused the gradual discontinuance of this production. The French grew considerable quantities in St. Domingo up to the period of their losing that possession; and about half a century back indigo formed an important item in the exports from Jamaica. The indigo of Spanish America was, however, always better esteemed; and, until a very few years back, this was the country, whence this dye was principally imported into England. Of late the trade has reverted to its ancient channel; and, by improved methods of preparation in very extensive factories, the Hindu indigo is not only brought into successful competition with that from America, but in some parts of India, and especially in Bengal, this substance is produced of a quality much superior to any that is brought from South America.

The indigo of Java was formerly considered to be the best that came from the East; but since the great improvement adopted in the mode of preparing this dye in the East India Company's possessions, and the consequent large importations thence, that of Java has fallen into comparative insignificance. It is only within the last one or two years that the greater attention paid to its cultivation has again brought the produce of that island into favour; so that its sup-

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INDIGO — (INDIGOFERA TINCTORIA).

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plies have considerably increased, and appear likely to become of still greater importance.

The export of indigo from Java amounted, in 1828, only to 24,000 pounds weight; the production of the island in 1829 was 152,000 pounds weight, and it is rapidly increasing. This increase is chiefly to be attributed to the encouragement held out by the government for the cultivation of the plant.

Since the production of indigo has excited so much attention in the East, it has been likewise manufactured in the Philippine Islands, but the product is of very inferior quality.

The general characteristics of the *indigofera* plant are leaves placed in pairs, or alternate, or in threes, or winged; that is, having leaflets placed on each side of a petiole or foot stalk. The flowers are small and papilionaceous, growing in clusters upon short axillary peduncles. According to Linnæus, the essential character of this genus of plants, is an open calyx, having the keel of the corolla furnished with an awl-shaped spur. The fruit is a linear legumen, approaching to cylindrical, and enclosing some kidney-shaped seeds.

There are several species of *indigofera* which produce indigo. Among these the following are most deserving of notice: —

Indigofera tinctoria is indigenous to India. It is a small shrub, rising with a straight slender stalk to the height of two or three feet, and garnished with small branches. It has a tap-root which extends two or three feet in depth. The stem becomes in time ligneous and brittle, and sometimes divides itself from the base of the plant into little stalks. The bark is of a greyish colour, intermixed with green. The stalks are cylindrical as well as the root. The leaves are winged, each having about four pair of oval leaflets terminated by an odd one. These leaves are soft to the touch, and somewhat resemble those of lucerne. The branches bear little flowers of a purple colour, in growth and size like those of broom. These flowers are succeeded by legumes about an inch in length, containing hard, brown, shining seeds. The leaves of this species have a greater proportion of colouring matter than those of any other kind.

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In some parts of the West Indies the *indigo tinctoria* is likewise called French indigo. This species is most abundantly cultivated in both the Indies.

Indigofera argentea—differs from the former in the superiority of its height, this being about six feet. The leaves are likewise winged, but the leaflets are longer, narrower, and somewhat thicker, and they are of a brighter green. Their reverse is furnished with a fine prickly down, easily detached, and very annoying to those who are engaged in gathering the crop. The flowers are of a reddish or purplish green; the seed vessels are more curved than those of the *Indigofera tinctoria:* the seeds are black and shining, somewhat resembling grains of gunpowder. It is usual to cut this species when it has attained about three feet in height, and as soon as it begins to flower. The management of this kind of indigo is more difficult than that of the French, and the grain of the fecula is not so large. But these disadvantages are considered by some planters as being more than compensated by advantages peculiar to the kind. It is of a much more hardy nature; it sustains the changes of seasons, and succeeds in most soils; while it resists much better the attacks of insects, and the effects of heavy rains. This species is cultivated in Barbary and Egypt.

The *Indigofera Americana,* or *Anil,* resembles so very much the *argentea* that it is scarcely possible to distinguish them from each other, except by the shape of their seed-vessels, and by the colour of their seeds, these being of a reddish brown.

The *Americana* produces less indigo than the *tinctoria,* but the dye is of a finer quality; this is the species which is usually cultivated in Guatimala, where it is native; it is now cultivated in the East Indies also.

Another species of indigo grows wild in the savannahs, and other uncultivated spots of the tropical regions of America. It is a little shrub, the stem of which is short and bushy; the whole plant is large in comparison with the other kinds. The leaves are small, round, and very thin. It is never cultivated, is in general considered unmanageable, and the dye is scarcely worth the expence of preparation.

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Another species nearly resembling the *argentea* was discovered by Dr. Roxburgh, and named by him *cærulea;* it grows spontaneously to the height of from one to two feet, on dry, barren, uncultivated ground, in some parts of India; on richer soils it attains to a greater size. It has no down on the leaves, which are composed of four or five pair of leaflets having one large terminal leaflet, and the legumes are very numerous on the same racemus. A more beautiful light indigo has been obtained from it in a larger proportion than from the common plant.*

Indigo flourishes best in a smooth, rich soil, well tilled, and not too dry, with a warm exposure. It thrives in newly cleared lands on account of their moisture. The plantation should be irrigated in times of drought, and protected against the danger arising from high winds. Indigo is generally a most delicate plant; but some of the species, such as the *argentea,* are much less so than others, and will grow on almost any soil. Although it has been cultivated in Carolina, between the 31st and 41st degree of north latitude, it is yet considered as more peculiarly a plant of the tropics, and requires that the temperature should never be below 60° for its successful cultivation, as well as for its preparation. The spring is considered the most favourable time for sowing the seed; it is highly advantageous that the rain should fall upon the plants as soon as they make their appearance above ground, by which means they are not only greatly invigorated, but are cleansed from innumerable insects which prey upon them, and might otherwise destroy the hopes of the planter. The sowing is performed either by depositing the seed in small holes made by the hoe at regular intervals,† or in drills two or three inches in depth, and twelve or fourteen inches

* 8lbs. of these leaves yield 241 grains of pure indigo.

† In the Caraccas, these holes are made about three inches deep, and two feet distant on good soil, but only ten inches apart on poor land. It is worthy of remark how prevalent is the error among tropical agriculturists, to burthen the soil in proportion to its disability of supporting vegetation — the contrary practice should be pursued.

In the French islands the holes are made only two inches deep, and five or six inches apart — as many seeds are deposited in one hole as "can be taken up by a finger and thumb," which are then covered with an inch of mould.

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apart from each other; in these drills the seed is placed in the proportion of about a peck to an acre; it is then lightly covered with mould. In favourable seasons the plants quickly spring up, and in three or four days after sowing they may be seen above the surface. The principal care required is to keep the ground clear of weeds, which, if suffered to remain, would quickly choke up and destroy the plants. These thrive best with a moderate degree of moisture; after the first rains, the dews, which are very abundant, supply nearly all the moisture requisite. The indigo-plant will survive through much drought in consequence of its spindle-shaped root, nearly three feet long, which is thus capable of deriving nourishment deep in the earth; while with excessive moisture it rots and perishes in the ground. It thrives most luxuriantly in cloudy weather, and with a tolerable degree of moisture; but the colouring matter is then deficient. This is found by analysis to contain an extraordinary quantity of carbon; its developement, therefore, requires that the plant should decompose carbonic acid gas very abundantly; and this cannot take place when it is deprived of the direct rays of the sun. As the plant approaches to maturity, the leaves undergo a sudden change in colour, turning from light to dark green. In three or four months from sowing, the plants begin to bloom, and then is the most favourable time for the first cutting; this is done with a sickle, the stalks being divided a few inches above the root. Some planters leave only one inch, being of opinion that the second crop obtained is then of a better kind; while others consider it best to leave as much as six inches, with the idea that a few branches from the stem assist in drawing up more luxuriant *rattoons*, or shoots of a subsequent growth; these afford another cutting in a few weeks, but the plants quickly deteriorate, and it is absolutely necessary to sow seed every year.

It is usual, at the first cutting, to leave some of the best plants for seed, which ought not to be gathered until fully matured and hard in the seed-vessel. Ten bushels of these legumes generally yield only a single bushel of clean, dry seed fit for sowing.

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The plant is liable to many casualties, which render this one of the most precarious crops of a tropical clime. An insect peculiarly destructive to indigo preys upon its leaves with insatiable voracity, leaving the planter to contemplate the sudden and almost total failure of his crop, without having been in any way able to guard against this disappointment to his hopes. Indigo planted the second year on the same land is almost certain to be assailed by these depredators. Edwards observes, in his history of the West Indies, that the only preventive against this evil is "*to change the soil every year.*" He adds, "the want of due attention to this important circumstance has probably been one of the causes that so many persons have failed in their attempts to revive the culture of this valuable commodity."

If the plant be gathered before flowering, the indigo which it yields is said to be of a finer colour, but much less in quantity. In Jamaica the planters sometimes obtained four cuttings in the year from the same root.

The indigo from the *indigofera tinctoria* is made with the greatest facility, but the success of this plant is very doubtful. It has a tender and delicate stalk, and is more peculiarly exposed to all the accidents which arise from the nature of the soil—the vicissitudes of the weather—the attacks of caterpillars and other insects.

The colouring matter of indigo is the feculent pulp separated from the plant—it resides principally and in some species entirely in the leaves; the whole plant is, however, usually submitted to the process for obtaining the dye. This is either effected by means of fermentation or scalding; the after process, likewise, differs in different places, and from each particular manner good indigo has been obtained. It is, however, a matter of some surprise, that the most simple and efficient method should not be generally known and pursued, and that experiments, conducted by enlightened individuals, should not, long ere this, have completely settled the question, by showing the relative merits of different processes. The experiments of Dr. Roxburgh stand almost alone on record, as having been made by a scientific man, to ascertain the best means of pre-

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paring indigo. The method strongly recommended by him more than thirty years back, is, however, but very partially pursued at present; and the old process, which depends upon practical skill rather than upon scientific knowledge, is still very generally followed.

Under these circumstances it may be most useful to give first an account of the method formerly practised at St. Domingo and other parts of the West Indies, and at present pursued in South America. The processes as practised in the East may next be detailed, and from these accounts inferences may be drawn as to which method is preferable for adoption.

In the Western hemisphere, an indigo plantation and an indigo factory, or, in other words, the cultivation of the plant and the manufacture of the dye are always joined together under one management. The requisite apparatus is generally erected under a shed to protect the workmen from the vicissitudes of the weather. It usually consists of three vessels adjoining to each other, and so disposed that the liquid may, by means of cocks placed in the side, and near to the bottom, flow from the first vessel into the second, and from the second into the third. In the first of these vessels the plants are steeped, and in the second the extract obtained from them is agitated,—the third is merely a kind of enclosure, the uses of which will be more particularly described hereafter.

The bottoms of the vessels are flat, with a slight inclination of about two or three inches to facilitate the transfer of the contents of one into the other. The first vessel, or steeping-vat, has at its side, near the bottom, a cock of about three inches in diameter (varying, however, in size according to the dimensions of the vessel), by means of which its contents may be conveyed into the second vessel, or agitating vat: this is furnished with three cocks, situated one above the other, about four inches apart. The third vessel, instead of having a cock, has an opening at the side, of about half a foot square, which is always unclosed, and communicates with the discharging pipe.

The vessels are usually formed of masonry. At those parts where communications between the vessels are required,

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thick pieces of hard, incorruptible wood are let in, and in these wooden cocks are inserted. Sometimes the vessels are merely strong wooden vats.

In an indigo factory it is always requisite to have a constant supply of water, and therefore, previously to erecting works, it should be ascertained that water can be readily obtained from some adjacent river, or that a spring may be made available by sinking a well. The vessels should be placed on a natural or artificial elevation, sufficient to allow of the liquor flowing off without danger of a reflux.

The first vessel may be made in the form of a square, or rather longer than it is wide. A convenient size is ten feet by nine, and about three feet in depth, including a small slope of about six inches, which forms a kind of rim or margin. It is not advantageous to make these vessels very large, since fermentation is not produced in them so quickly or so equably as when they are of a moderate size. The product of a large vessel is much inferior to that of two others which will contain together the same quantity of indigo plants.

The second vessel, in which the agitation is conducted, is usually constructed too deep,—it being from five to five and a half feet in height, including masonry two feet high, which serves as a brim to the vat. When the process is described, it will be seen that a vessel answers the purpose better, made as shallow as circumstances will permit,—eighteen or twenty inches in depth of liquor being as much as should ever be allowed; the brim should be about the same height to prevent the contents from splashing over during agitation. This operation was formerly performed by manual labour,—buckets with holes in them and attached to long poles being continually moved up and down by workmen. These buckets were afterwards set in motion by horses, mules, or water-mills, but now the necessary agitation is generally produced by better means, either by wheels or by some other revolving machinery arranged in a more convenient manner. The third vessel is of no determinate size, the masonry which divides it from the agitating vessel forms one of its sides in length, six or seven feet are sufficient for its width. The bottom of this is level

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with the exception of a small circular basin, hollowed out in the surface and touching the side of the agitating vat, whence the fecula flows into this basin. It is about two feet deep and two feet and a half diameter, a little sloping at the side next to the adjoining vessel. At the bottom of this basin there is another hollow of about five or six inches diameter and of the same depth, this is for the greater convenience of taking up the fecula which remains at the last, and for allowing sand and other heavy impurities to settle therein. The height of the third vessel is from three and a half to four feet, reckoning the bottom six inches below the lowest cock of the agitating vat. A small ladder is always placed against the side of this vessel for the facility of going in and out at will. The masonry of these vessels, and above all of the first, should be made with great care and solidity that there may be no leakage, and that it may be in a state to resist the violent efforts of fermentation. The sides of this first vat are sometimes made of fifteen, twenty, and even twenty-four inches in thickness; twelve or fifteen inches are sufficient for the thickness of the other. The bottom is made with great care. When all the masonry is thoroughly dry, the interior of the vessels is thickly lined with cement, which is laid on very evenly and polished as it dries.

Violent fermentation very quickly ensues in the first vessel, and it becomes necessary to restrain this or the contents would quickly flow over. For this purpose, posts of strong wood are driven very firmly into the ground at each corner of the vat, rising about a foot and a half above its top; these have a strong frame work attached to them. When the plants are put in for fermentation, thick planks of wood and rafters crossing them, are placed under and kept down by this frame.

Three forks, or curved pieces of wood, arranged in the form of a triangle are fixed in the opposite sides of the agitation vat, to serve as fulcrums for the play of the buckets employed to beat the contents of this vessel; but machinery is now so generally used for this purpose, that it is useless to give any farther description of these agitators.

The quality of the water used has a great influence upon

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the preparation of indigo. River water, when not too cold, is found the best for penetrating and extracting the colouring matter. Turbid, or muddy water, or that which is impregnated with earthy salts, alters considerably the quality of the indigo. Water kept too long a time, or corrupted by the presence of extraneous matter will retard or spoil the solution. Indigo prepared with salt water, has at first a very fine appearance, but after being some time exposed to the air, it never fails to attract humidity: this indigo is heavier than any other.

As soon as the plant is cut, it is placed in regular layers in the steeper, till within about ten inches from the top, This preliminary being accomplished, the vessel is filled with water, rising three or four inches above the plants. The water is admitted by means of a pump and a gutter, or wooden channel communicating with it.

The frame-work is then fixed with the planks of wood, care being taken not to confine the plants too much. A very few hours after the water has been poured in, bubbles of air are seen to rise to the top, and considerable commotion ensues; some of the bubbles in bursting spread a green tint over the surface, and by degrees the whole of the water is changed into a lively green colour; other bubbles gradually collect into patches of froth. Heat is generated, and the bulk increases considerably, the green hue is then at its highest degree; the surface of the liquor is next partially overspread with a copper-coloured film, which, in its turn, is effaced by a pellicle of a deep violet-colour, although the entire mass of the water always remains green. When the contents of the vessel have attained to the proper degree of fermentation, the froth rises up in the form of pyramids. The indigo, in this stage, is in such a violent state of commotion as sometimes to break the bars of the frame-work, and even to tear up the posts when they have not been driven very deep into the earth. This fermentation causes the perfect dissolving of the base of the colouring matter. It lasts from twelve to sixteen hours, continuing for a longer or shorter period, according to the quality and nature of the plant, the temperature of the season, and the state of the weather. If suffered to continue beyond the

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favourable point the bulk will begin to diminish, and gradually it will return to its original dimensions; putrefaction will then take place, and the whole dye be destroyed. On the other hand, if drawn off too soon, much of the colouring matter will remain unextracted, and will consequently be wasted. It has always been a very difficult task to ascertain the precise period when the fermentation has reached the most favourable point. Many experiments have been made, with a view to place this matter beyond a doubt, but the experience of a practised eye is more valuable than any stated rule which can be given. Some operators draw out handfuls of the plants every five minutes, and as soon as the leaves are seen to have a pale colour and the tops are tender, the liquor is drawn off into the agitating vat. Others judge from the appearance of the liquor, a small quantity of which is examined from time to time, and if it appear, when viewed falling from one vessel into another, of a bright yellowish green, and will readily pass through the closest filter, until the action of the air makes it turbid, then it is considered in a fit state to be passed into the second vessel. Another method recommended as the result of experiments carried on at St. Domingo, under the sanction and encouragement of the chamber of agriculture, is to make a few strokes on white paper with a pen dipped in the liquor, and this to be repeated every quarter of an hour until it is no longer coloured. The time in which the fermentation is carried on, differs according to temperature and other circumstances, varying from ten to twenty or even to thirty hours.

As soon as the liquor is transferred to the second vessel, the steeping vat is cleansed; fresh planst are thrown in, and the work goes on without interruption. The refuse matter should always be thrown away immediately, since the noxious smell of this occasions that peculiar unhealthiness which is always incident to the business.

The liquor, in passing to the agitating vat, quickly assumes a deeper green colour, and in that precise state indigo, perhaps, is in the most favourable situation for imparting a permanent dye. The subsequent operations are therefore pursued in order to collect the substance of the colouring matter into a

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solid mass, in which form it may be the better preserved and transported to distant countries for use. The base of the colouring matter is in this state held in solution; its combination with the oxygen of the atmosphere renders it *insoluble*, and changes it from a green to a blue colour. The agitation is therefore intended not only to check further fermentation and prevent putridity, but is essentially requisite, that, by continually changing the surface of the liquor, it may obtain sufficient oxygen from the air. The fecula combining with the oxygen, is no longer held in solution, and it separates in very minute particles, called the *grain* of the indigo. To expedite this business, it is evident that a large surface should be constantly exposed to the action of the air, and hence the advantage of shallow vessels.

Violent agitation is continued for some time during the course of the work. The French and Spanish method is, to throw a small quantity of oil, from time to time, into the vessel, for the purpose of dissipating the thick froth which rises in consequence of the agitation. About one pound of oil to as much liquor as will yield 72 lbs. of indigo, is the proportion usually allowed. As soon as the grain begins to show itself distinctly, lime-water is added, which acts by absorbing the remainder of the carbonic acid gas produced by the previous fermentation of the liquor. Great nicety is required to find the exact point when agitation should cease. If too little beaten, the grain would not be sufficiently separated; if too much, a second fermentation would be excited, which would alter the dye, spoil its colour, and make what is called *burnt indigo*. On the other hand, if the separation of the coloured particles were promoted by lime before they had acquired a sufficiency of oxygen by agitation, the indigo would have a greenish cast; which is considered an unfavourable appearance; although it is supposed by Dr. Bancroft, that in this state it would in some respects be preferable, as it could be more readily brought into a state of solution previously to its use for dyeing. The lime-water used, should be perfectly clear; otherwise it will render the indigo hard, heavy, and of a greyish cast. While the agitation is continued from time to

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time, a little is drawn off and examined in a glass: if after being allowed to rest during a short time, the grain separates readily from the liquor, it is then supposed to have attained the most favourable point; the agitation is discontinued, and the whole is left for subsidence; the flocula gradually precipitate, leaving the supernatant liquor clear.

Dr. Roxburgh recommends, that while this precipitation is going forward, the surface of the liquor should be gently agitated, or fanned by the air, as this prevents the formation of a violet or copper coloured scum, which should not be suffered to gather, since it impedes in a great measure that free absorption of oxygen, which is so necessary to the separation of the whole of the colouring matter from the water.

A period of two or three hours usually suffices for this subsidence; but where dispatch is not of consequence, it is much better to leave the whole undisturbed for a longer time, in order that the smallest particles may be deposited, and by this means less water will be mixed with the sediment. An experienced planter in the isle of France used to allow this repose to continue for twenty-four hours, and it is said that he obtained in consequence, indigo of a very superior quality.

When the water is allowed to flow off, the upper cock is first turned, and all the liquor above this level escapes; the second cock, which is just above the layer of fecula extended at the bottom of the vessel, is then opened. The water flowing from these cocks, will of course, fall first into the receiver; and thence, when this is full, will go forward to the enclosure or third vessel; whence it should be allowed to escape by the opening already described, into some ditch or abandoned pool. It is forbidden by law to let it flow into any stream to which cattle can resort, since it would render the water poisonous and destructive to animal life.

If the indigo has been properly made, the water issuing from these two cocks should be of an amber colour, and should flow quite clear; when this has all passed off, the third cock is turned a little to allow of the partial escape of the water mixed with the fecula; the receiver is then emptied of the water; the cock is entirely turned, and the indigo now falls

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into the receiver. In this state the indigo resembles fluid mud of a blue, almost approaching to a black colour. That there may be no waste, a workman generally descends into the agitating vat when it is nearly empty, and with a broom forces out the remainder of the indigo. The fecula in the receiver being still surcharged with moisture is transferred into bags to drain. These bags are usually from a foot to a foot and a half in length, terminating in a point at bottom, and are about eight or nine inches diameter at the top. They are made of strong linen cloth, but not of very close texture. They are furnished with loops at top, by which they are suspended to the pegs of a rack. The indigo is thus left to drain until the next day. When the bags, hung separately, do not give out any more water, the loops of several are united together and they are suspended on one peg; in this manner they press against each other, and a further portion of moisture is forced out. The indigo is then emptied into cases, and the bags are washed and dried previously to their being used a second time. The cases are made of wood, and are about three feet in length, one foot and a half wide, and two inches deep. These are exposed on platforms, one part of which is under the shelter of a building called the drying-house, and the other is in the open air. At one end of this shed is a place for keeping the indigo when it is entirely dry. The indigo is placed under shelter during the night and in rainy weather. In the day time it is exposed to the rays of the sun till completely hardened. The drying, however, must be gradually pursued, and the evening is therefore usually preferred for the commencement of this operation, because too intense a heat, if long continued at first, blisters the surface and makes it rough; this effect does not happen, when, after five or six hours of exposure to heat, it has an interval of coolness, which gives time for the mass to take an equal consistence throughout. A trowel is then passed over it, in order to press the parts firmly together, and to make it of one smooth and uniform surface; this, when the indigo has acquired a suitable degree of solidity is again polished, and the whole is divided into little squares. It is still continually exposed to the sun's rays, not only till

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the squares are easily detached from the case, but until it appears thoroughly dry.

The process is not, however, yet completed. If the squares were packed in this state, they would in a very short time become deteriorated. They are now laid in a heap and covered with dry plaintain leaves, and in this situation are left for about three weeks. During this period, the indigo undergoes a second fermentation. It heats considerably, and gives out large drops of water; emits a disagreeable vapour, and becomes covered with a fine meal. It is then uncovered, and without being exposed more to the air, dries in less than five or six days. It has now acquired a greater specific gravity, and in this state is fit for sale and exportation. In the first six months after its preparation, it however diminishes in weight considerably, and therefore it is to the interest of the factor to sell it as soon as it is made: this diminution in weight is valued at ten per cent. and sometimes even much more.

Some factors, as soon as it is taken out of the cases, dry their indigo in the shade; this is a tedious process, often extending over six weeks; but the quality of the indigo is, it is said, much superior to that dried in the ordinary way. Neither, when thus treated, does it lose in weight by being kept.

In the East Indies, the production of indigo is conducted on a different system, occasioned by a law which remained in force until a very recent period, and which prohibited Europeans from taking the land into their own hands for agricultural purposes: they were therefore of necessity constrained to depend on native industry for obtaining the raw produce of the soil.

The indigo is for this reason cultivated by the ryots or native farmers, to whom the factor furnishes the seed, and gives other facilities and accommodations in the shape of loans; thus, the ryots become dependent on the factor, and bind themselves to dispose of all the produce of their indigo plantations to him alone at a fixed price. The factory is in general on a very extensive scale, many ryots contributing to

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supply the material; to raise which, many thousand acres of land are required.* A large capital is usually embarked in one of these undertakings, and more than one proprietor is concerned in its success. In general, the junior partner superintends the working of the concern, and watches over the process, which he believes is to bring him wealth, with no little share of interest and care: it is therefore matter of surprise, that there are not greater improvements made in the different operations than have already taken place; since, even now, much may be found in the detail which is faulty, and which might be altered with advantage. At the same time, it must be owned that the factor of Bengal succeeds much better than the planter of America in producing a superior article; the indigo coming from Madras, however, is still of an inferior quality.

Fermentation and agitation are pursued in Bengal on exactly the same principles and with the same results as we have already described, but when the indigo arrives at the point of subsidence, and the supernatant liquor is drawn off, a new process is pursued. This is the *boiling* process, which immediately follows that of *beating*. It is now the usual practice in Bengal to convey the fecula, which at this period is in a liquid state, from the agitating vat to the boiler, wherein it is brought, as soon as possible, to the boiling point, after which the hot fecula is let off direct on large cloths placed on a table so constructed as to allow the draining off of the moisture. As soon as the fecula settles itself into a consistent mass it is pressed and exposed to the air till quite dry.

The intermediate operation of boiling is considered to be beneficial in preventing a fermentation of the fecula, which is known sometimes to occur during the process of draining,

* The Hindû husbandry is in this, as in most instances, very unproductive compared to that of other countries. Recently, perhaps, the cultivation of indigo may be conducted with better results than those recorded by Tennant in the second volume of his Indian Recreations, wherein he states, "that the produce of an acre of ground tolerably productive, does not yield upon an average, more than from six to ten pounds of indigo." Dr. Brown, in his Natural History of Jamaica, says, "that four crops of indigo may be taken from the land in a year, and that in this manner, an acre will sometimes yield five hundred pounds."

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and facilitates this subsequent step by holding in solution the gummy and other matter, unavoidably extracted from the plant, together with the colouring-matter: this extraneous part is thus enabled to pass off with the water, otherwise it would clog the draining-cloth, and finally settle with the fecula to the deterioration of its quality. There appears little reason to doubt that the boiling process has this good effect, and it is to be regretted that this improvement in the preparation should not be carried on under the most favourable circumstances. This, however, appears far from being the case. The boilers are built on a wretched construction, the bottom only being of metal, while the sides are built up of solid masonry. The bottom is, therefore, alone exposed to the action of the fire, and, in consequence, the efficiency of the vessel is most materially lessened; besides this, fuel is wasted, since the heated air, which, before it passes off up the chimney, might be made to give out its heat to the sides, is now at once drawn off and prematurely escapes. Time is likewise lost, since the fluid is of course constantly imparting to the masonry a portion of that heat which it imbibes, and for this same reason the liability to the greater evil of charring is much augmented. If a better arrangement were adopted for carrying on this operation, it might be more simplified and carried further than is now consistent with prudence.

We have been favoured with the above account of the Bengal process, by a gentleman who was for some years the successful and active superintendant of his own very extensive factory. From the same excellent authority, we learn that the employment of boiling *instead* of fermenting was tried by a factor and the produce sent to England, but that the dyers did not report favourably of the indigo thus made.

The objections made to the indigo obtained by the scalding process, are, that it is very spongy and light; that it contains much less colouring matter than that obtained by fermentation, and that the dye produced is more evanescent.*

Such an inveterate prejudice frequently exists against those

* Heyne's Statistical Tracts.

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things which assume an appearance different to that which we have been accustomed to associate with the idea of excellence, that it is not impossible the dyers might be, at least in this case, mistaken in their opinion.

The preference given by Dr. Roxburgh to scalding over fermenting is so decided, and the reason for this preference is so forcibly put, the conclusions appearing to be drawn from the test of experiments pursued by him, that one is unwilling to believe that a process, which he so unhesitatingly recommends, could have proved on farther trial, to be valueless and unworthy of adoption.

In the scalding process, the doctor recommends that copper vessels should be employed; ten or twelve feet long by five or six feet wide, is, perhaps, a suitable size; the depth should not be more than two feet, lest the leaves near the bottom should be too much scalded before those at the top have all their colouring-matter extracted. The after operations of agitating, &c. are pursued exactly in the same manner as when the fermenting process is employed.

When scalded, the indigo is not made up into cakes, but is left to dry after it is strained, either in powder or in small lumps.

The advantages of scalding over fermenting are thus set forth by Dr. Roxburgh :—

"By the scalding process I have always, on a small scale, made from the common indigo-plant, better indigo than I could by fermentation, and in one-fourth of the time; and what is also of great importance, without the smallest degree of the pernicious effluvia which attends the manufacture of indigo by fermentation; and, moreover, the twigs and leaves themselves of the indigo-plant burn fiercely, after having been well dried, and will carry on the operation without requiring any great addition of other fuel."

"Besides the superior *quality* of the indigo obtained by the scalding process, the quantity is generally encreased by it; for in this way the whole of the colour is always extracted at first, if the scalding has been continued long enough; which is not the case by fermentation, as the leaves will yield indigo

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upon being fermented a second time. Moreover, the health of the labourer in this way, is not endangered, as in the fermenting process, by constant and copious exhalations of putrid miasma: the heat employed expels most of the fixed air during the scalding, which renders a very small degree of agitation, and very little of the precipitant (lime-water) necessary. The operation can also be performed two or three times a day upon a large scale; and, lastly, the indigo itself dries quickly without acquiring any bad smell, or putrid unwholesome tendency." *

The following method of preparing indigo in the East Indies, is taken from the Encyclopedia Americana, by which it would seem, that in different parts of Hindostan, dissimilar processes are successfully pursued.

The plants are cut early in the morning and spread out in the sun until the afternoon, when the leaves are dry enough to be beaten from the branches with sticks. The leaves are then housed in warehouses, closely packed and trodden down by the natives, and remain in this situation for a month before being used. During this time the leaves undergo a material change, indicated by their passing to a light lead colour, which hue gradually darkens until it becomes nearly black. The maximum quantity of indigo is obtained from the leaves when of a lead colour. Steeping-vats are used, of about thirty feet square and twenty-six deep; these are constructed of brick lined with stucco. The dried leaves are put in them and water added, in the proportion of six volumes of water to one of leaves. The whole is constantly stirred during two hours, when the water will have acquired a fine green colour, it is then drawn off through strainers into the agitating vat, and beat by the paddles of ten or twelve natives, for about two hours longer: in the course of this time the green colour of the liquor gradually changes to that of a dark-blue. The criteria for judging when this process has been sufficiently pursued, are derived from the incipient separation of the particles of

* Dr. Roxburgh, in Appendix to Dr. Bancroft's Philosophy of Permanent Colours, p. 423 and 444.

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indigo which become visible by pouring a small quantity of the liquor into a white earthen dish. At this time lime-water is added, and the whole is violently agitated. It is then left during three hours for subsidence. At the end of that time the supernatant liquor which should appear of a bright Madeira colour, is withdrawn by orifices in the vat at different heights. The fecula is then put into a straining cloth and allowed to drain during the night. On the following morning it is transferred to a copper-boiler, where it is mingled with a quantity of water and raised to ebullition; as the mass is gradually heating, a quantity of scum rises, which is immediately removed, and as soon as the whole is brought to the boiling-point, the fire is withdrawn. The contents of the copper are now transferred to the strainers, and when the indigo has sufficiently drained, it is then divided into small portions, and each portion is well worked by the hands of the natives to free it from air-bubbles. It is then submitted to pressure in boxes, which are usually square and of sufficient depth to leave the cake two and a quarter inches thick, the water being separated by means of a powerful screw; the cakes are then gradually dried in the shade and are thus made fit for exportation.

In the above process, it appears that simple infusion is sufficient to obtain an extract from the dried leaves, and that neither fermentation, nor scalding, is absolutely necessary to dissolve the colouring matter.

The dyers of Europe are prejudiced against this method of preparing indigo, as well as that by the process of scalding. It is considered that the colouring matter is not so much compressed, and that a given quantity of this does not produce the same effect as an equal quantity of indigo produced by fermentation. Dr. Heyne made many experiments on an extensive scale, as to the relative merits of indigo prepared in different manners, and the results led him to believe, that the dye obtained from the dried leaves, was more durable than that obtained by the other methods. This manner of preparing indigo has been long practised in the Carnatic, and along the coast about Tranquebar, Cuddalore, and Puerto Novo, places formerly, and even at present, famous for the

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finest blue dye upon cotton. The natives are so partial to this indigo, that they believe their superior dye could be produced from none other but that.*

The method by scalding, Dr. Roxburgh does not claim as his discovery, since, in many parts of Hindostan, the natives prepare indigo in this manner.

Dr. Heyne observed, along the road from Bezwadah to Timmericotah, a great quantity of wild indigo — *indigofera pseudo tinctoria*—and on one spot saw a considerable number of people engaged in manufacturing indigo from it by the scalding process. These plants grow abundantly among the hills, and the people are annually employed after the rains to collect the leaves, and manufacture the colour from them. The plants in their uncultivated state flourish luxuriantly, and are uncommonly rich in leaves, which it is said yield a superior kind of indigo.†

At Ambore, the plant is boiled in water, in earthen pots of about eighteen inches diameter. When the colour of the liquid indicates that the scalding has entirely extracted all the colour, the contents of the earthen vessels are immediately poured into another jar fixed in the ground for its reception, and are thence laded into smaller pots, whence the liquid is filtered through a cloth into larger jars. When these are three-quarters full, the contents are agitated with a split bamboo, made into a hoop of from thirteen to twenty inches diameter; a kind of coarse straw is twisted round this hoop, with which the manufacturer beats, or agitates, the liquor, until the fecula begins to granulate; this rarely takes place till after nearly three-quarters of an hour's brisk agitation. A precipitant, composed of red earth and water, is then poured into the jar. The whole is left for subsidence during the night, and in the morning, the supernatant liquor is drawn off through apertures in the side of the jar; the lowest of these apertures, being within five inches of the bottom; the fecula, which does not reach so high, is then put into bags, drained and dried.

In the northern parts of the coast of Coromandel, the natives use as a precipitant, a cold infusion of the bark of the jambo-

* Heyne's Statistical Tracts.

† Ibid.

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long tree (*jambolifera pedunculata*). This is considered very inferior to lime-water as a precipitant, while the red-earth and water used at Ambore, is decidedly prejudicial to the quality of the indigo; yet, notwithstanding, the indigo thus produced by the Hindus is of excellent quality, being very light and of a fine colour. Dr. Roxburgh, attributes this result wholly to the scalding process, since in every other respect the plan pursued by the natives is inferior to the European methods, for the whole apparatus employed is very inconvenient, and the operations are carelessly conducted. A strong proof of the good effects of superior machinery, is here afforded, since in the European factories of India, one man can bring to issue, one vat containing fifty bundles of indigo plants, which, according to their quality, yield from ten to thirty pounds of indigo, in the same space of time which a native consumes to produce one pound of indigo.*

The Javanese† pursue, we are told, a method dissimilar to any that are mentioned above. They first ferment the plant, and then boil the extract for a short time previous to agitation, and apparently use no other means to assist the granulation and precipitation. The indigo thus prepared is said to be very fine.

In Egypt, the plant is dried before the colour is extracted; it is then put into an earthen jar with hot water, and worked up and down with a palm branch: all the colouring matter is by this means dissolved; the liquid is then strained through the bark of a tree into another earthen vessel and left in this situation for eight or nine days, during which time part of the water escapes by trickling through a small aperture half way down the side of it, leaving the sediment at bottom. The fecula is then poured into a broad, but very shallow hole, formed in the sand, which absorbs the remaining liquid and leaves the indigo in solid cakes on the surface.‡

In some parts of Africa, the balls of indigo prepared for use

* Asiatic Researches, vol. iii.

† M. de Cossigny's Treatise on indigo.

‡ Journey to two of the Oases in Upper Egypt, by Sir Archibald Edmonstone, Bart.

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are simply the leaves of the plant rolled up. At Senegal, the leaves are gathered at any time of the year, and merely pounded in a mortar till reduced to a paste. The mass is then made up into loaves, dried, and preserved for use. When required for dyeing it is dissolved in a lye made of the ashes of an unctuous plant growing wild in the fields, and which is called by the natives *rhemi*. Into this solution the cloth to be acted upon is immersed, and in this manner a permanent dye is obtained, far surpassing ours in brilliancy, and which acquires additional lustre by repeated washings.* It may be easily understood, that when used in this, its natural state, a richer and purer dye would be imparted than by means of the indigo employed in an European dye-house, where it must be deprived of its oxygen by union with some extraneous substance before it can be held in a state of solution, and thus be placed in a situation to impart its colour, which may then, perhaps, be in combination with some other matter injurious to its properties.

The indigo of commerce varies considerably in colour. It is distinguished into blue, purple, violet, and copper-coloured. That which is of the least specific gravity is always considered the best. It is not known, though the knowledge has always been considered a great desideratum, how each peculiar colour of the indigo is produced, and how it may be certainly obtained at the option of the operator. The same colour and shades of colour may be imparted by all the different kinds of indigo; the quantity required to produce the same effect varying in each. This sufficiently shows that the principal difference consists in the proportion of impurities, and consequently on the greater or less amount of colouring matter contained in a given quantity.

The indigo of the smallest specific gravity is most esteemed, because of its being most free from impurities. The purest indigo of commerce which Bergman could procure, he found, on analysing, to contain more than half its weight of extraneous matter, one hundred parts being composed of

* Adamson's Senegal.

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parts.	
47	pure indigo
12	gum
6	resin
22	earth
13	oxide of iron

This sublimes at a heat of 550° Fahrenheit, and decomposes soon after. Its vapour is of a rich violet-colour, and is condensed by cold into delicate acicular crystals of perfectly pure indigo. When purified by sublimation, indigo consists of

parts.	
73.26	carbon
12.81	nitrogen
10.40	oxygen
2.50	hydrogen

Pure indigo is insoluble in either water, alcohol, æther, or oils. It is not acted upon by the alkalis, nor by most of the acids. Nitric acid converts it into a dirty white colour, and, at last decomposes it completely. Sulphuric acid dissolves it and gives to it a more lively, though less durable colour than it naturally possesses. Sulphate of indigo is used in dyeing, and is known in commerce as Saxon blue. It obtained this name from the circumstance of the process for making it being first discovered and practised in Saxony, in 1740.

The quantity of indigo consumed in Europe renders this a very important branch of commerce, and the nice shades of difference by which it is distinguished in price and quality, sufficiently show the variety of countries whence it comes, and the degree of estimation in which each is held.

It at present forms one of the most important articles of importation from the East Indies; and a few years back its cultivation there was attended with immense advantages, large fortunes being made by the proprietors of factories in a very short period.

The market is at present more abundantly supplied, and consequently the prices obtained do not leave such large profits. The returns of such a concern are extremely uncertain; sometimes the crops wholly fail, at others, mismanagement

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will swallow up most of the proceeds; and although it may have been very common to obtain wealth by an indigo factory, it is, unhappily, now far from uncommon to lose both fortune and health in the pursuit. If the cultivation were under the controul of those who could see, and seeing, would know how to avert all threatening dangers; this might no doubt be still a very profitable undertaking. It is reckoned that, on an average, an acre of land, by proper cultivation and management, may be made to yield 300 lbs. of indigo annually. If we calculate this quantity, at the average price given at the end of this chapter, it may be presumed that large profits will be realised, after allowing a fair proportion of the proceeds for the expences of preparation, freight, and other charges.

The actual results of the working of an indigo factory in Bengal, situated in Gondivārā-puraniya, will however better exhibit the profit or loss likely to accrue from this employment of capital. The following statement is extracted from a statistical survey of Bengal by Dr. Hamilton, the manuscript of which is deposited in the library of the East India company.

	Bundles of plants.		Factory maunds of Indigo.
In the year 1800..	41,764	yielded	131
1801..	48,834	..	162
1802..	26,083	..	109
1803..	74,525	..	278
1804..	93,945	..	381
1805..	138,798	..	536
1806..	92,770	..	310
1807..	166,106	..	752

Twenty thousand bigahs of ground (about 6,666 acres) produced 240,000 bundles of plants, which yielded 680 maunds of indigo, about 50,782 lbs. or not quite eight lbs. per acre, a result very different to that assumed as an average crop (300 lbs. per acre) both by Brown and Edwards.

The actual result of the operation of fifty-six indigo fac-

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tories in various parts of Bengal, Behar, and Benares, for the last six years preceding 1831, is given in the Report of the House of Commons on East India affairs for 1831.

The gross amount of outlay during that time was one crore and seventy-seven lacs of rupees, or 1,770,000*l.* The returns were two crore and twenty lacs, or 2,200,000*l.* The average yearly outlay, without including interest or commission, thirty-one lacs and 93,000 rupees, or 319,300*l.* The average yearly return, thirty-nine lacs, 81,000 rupees, or 398,100*l.* The gross profit upon that being seven lacs, 96,000 rupees, or 79,600*l.* A deduction from this might be made of eighteen or twenty per cent. for charges and interest of money, giving the net profit between 65,372*l.* and 63,680*l.*

The value of indigo exported from Bengal is at present very considerable, but of course it varies according to the price obtained for it in Europe, which influences the Calcutta valuation. It is stated to be from two to three millions sterling.

The quantity too is very uncertain, depending on the season. The average may be taken at 120,000 maunds (about 9,000,000 lbs.) annually; sometimes more, sometimes less. The indigo of Bengal is chiefly exported to England, some to America, some to France, and a small quantity to the Persian gulf. The consumption of France has increased of late years, a fact which is not to be gathered from the returns of our custom-houses. The commercial jealousy which France has imbibed against this country, induces its government to forbid the importation (for consumption) *from England,* of all goods the produce of either Asia, Africa, or America; and as one consequence of this policy, it has become a practice with our merchants to send their indigo from this country to the United States of America, whence it finds its way to France, burthened with double freights, insurance, and other charges, and attended by a loss of time which also enhances the cost to the consumer.

It is said that there are from three to four hundred indigo factories established throughout the Bengal provinces; in addition to which, there are a great many small factories conducted by natives, who have lately begun to imitate the European pro-

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cess of manufacturing indigo, and have invested large funds in the undertaking.

Indigo is manufactured at Madras, but in only small quantities, and the quality is very inferior to that of Bengal. It is said the reason of this inferiority is occasioned by the indigo being prepared from the dried leaf, the method of doing which has been described.

A considerable quantity of what is called mud indigo is manufactured by the natives of Madras, this is merely the leaves and stalks mixed up altogether, which are there at once applied to the purposes of dyeing without previously extracting the colouring matter.

Quantities of Indigo imported and exported, and retained for Home Consumption, from 1827 to 1831 inclusive.

	1827.	1828.	1829.	1830.	1831.
	lbs.	lbs.	lbs.	lbs.	lbs.
Imported	6,067,747	9,913,010	6,748,281	8,216,440	7,307,313
Exported	3,085,465	4,588,658	4,286,605	4,636,748	4,374,241
Cleared for Consumption	2,396,490	3,064,915	2,113,830	2,676,945	2,490,134
Net Revenue	£ 31,379	39,367	28,169	34,262	31,782

The following List of Prices, exclusive of Duty, will at once shew the varieties of Indigo and their relative Market Value.

		s.	d.		s.	d.	
Bengal	from	3	3	to	6	3	per lb.*
Oude	„	1	0	„	3	9	
Madras	„	2	2	„	3	6	
Java	„	3	0	„	4	0	
Manilla	„	1	10	„	3	9	
Guatimala	„	2	0	„	4	9	
Caraccas	„	3	0	„	5	0	

The Duty on that coming from British Possessions is 3*d.* on other sorts 4*d.* per lb.

At the close of the last century, Dr. Roxburgh transmitted from India an interesting account of a kind of indigo more

* Eight qualities are designated in the Price Current.

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beautiful than that obtained from the common indigo plant, and which was extracted from the leaves of a tree. Although Europeans who manufactured indigo had not before that time availed themselves of the properties of this tree, it appears that the natives of the Vezigapatam and Ganjam districts had long been acquainted with them, and that they were in the habit of making indigo from its leaves at a period prior to the discovery made by Dr. Roxburgh. This tree is called by the Hindûs, the *tshit ancalloo;* it is a species of *Nerium* distinguished by the doctor as *Nerium tinctorium*, or dyer's rose-bay. The trunk of a full grown tree, is from one and a half to two feet in diameter, and from eleven to fifteen feet high before the beginning of the branches; it grows in a very irregular form; the bark, when old, is scabrous, but when young, smooth and ash-coloured. The wood is white and close-grained. The leaves are numerous, growing in pairs opposite to each other on short petioles. When they have attained their greatest growth, they are from six to ten inches long, and from three to four broad; they are nearly oval, but terminate in a point. The flowers are handsome, and of a blue colour. This tree grows abundantly throughout the Carnatic, and in every part of the Circars where there are hills or mountains, being an extent of country of above one thousand miles in length. A milky juice is contained in the tender branches and young leaves, and readily exudes on their being wounded. It is extremely good wood for fuel; the natives use it for this purpose, and therefore near inhabited places it is usually found only in the state of a very small tree or bush. The most favourable manner of pruning it to obtain the greatest supply of leaves, is the same as that in use in mulberry plantations. It is kept low, and like them, the more it is cut down, the more vigourously will it grow; many shoots issuing from the old stumps and growing to various heights from one to ten feet, according to the nature of the soil and season. The tree sheds its leaves at the commencement of the cold weather; at the earliest spring it begins to put forth its new foliage, and to expand its blossoms. By the end of April, those leaves which were first

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developed will have arrived at their full size. This is considered the most favourable time for commencing to gather them for the purpose of extracting their colouring matter. About this time also, the flowers fall off, and many of the seed vessels are already perfectly formed, although the seeds do not come to maturity until January or February.

The gathering of leaves may be continued during the four next succeeding months. In May and June they are most rich in colouring matter. At the end of August they begin to acquire a yellowish rusty colour, and are no longer in a fit state for yielding indigo. The leaves of very young trees do not yield any colouring matter; those raised from seed do not furnish any till they are more than two years old, and then in only a very small proportion. They likewise differ in one particular most essentially from the common indigo plant, they do not yield their colour to *cold* water. Dr. Roxburgh tried various methods to this end, but could only produce "a very small proportion of a hard black flinty substance which did not deserve the name of indigo;" but by means of hot water the colour is readily extracted.

These leaves yield the best indigo after being kept a day or two; when quite dry, they afford only a dirty brown colour.

The process required for extracting the colour as described by Dr. Roxburgh, is exactly similar to that which, according to his recommendation should be used in making indigo from the common plant. The leaves collected on the preceding day, are put into a copper vessel so as nearly to fill it without their being pressed together. Water is then poured over them till it reaches within two or three inches of the top of the boiler. The use of hard spring water is considered preferable, as it is found to extract the indigo in greater abundance, and of a better quality than when rain or river-water is used. The leaves and water being thus put in the copper, the fire is lighted, and heat is applied till the liquor assumes a deep green colour when viewed in the vessel. The leaves will then have lost nearly all their verdant hue, and appear of a yellowish colour; the temperature of the whole will at this time be from 150° to 160° Fahr. The scalding takes about three hours,

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during which time the leaves should be constantly stirred about, and turned up and down, that they may be equally exposed to the action of the fire. The agitation thus produced, has likewise another good effect in expelling the carbonic acid gas, by the separation of which the operation is much forwarded. As soon as the leaves and the liquid assume the appearances above described, the fire is immediately damped, and if there be more than one boiler, the contents of which are to be poured off into one common agitating vat, each should be in a state of equal forwardness that the whole quantity may be at once collected. In making this transfer the liquor should pass through a hair cloth to keep back every part of the leaves. It is then agitated in the common way while hot for a few minutes, and this will generally produce a sufficient granulation. Before the liquor is cool about $\frac{1}{15}$th part of pure lime-water is added; this being intimately mixed, a very large grain is speedily produced, which soon precipitates. After subsidence the supernatant liquor is drawn off, and the indigo is subsequently treated exactly as in making the common fermented indigo. If the process has been properly conducted, the liquor will be of a clear amber colour, which is a proof that it retains none of the indigo. To produce one pound of indigo, between two and three hundred pounds of green leaves are necessary; but the quantity will vary according to the season, and the state of the weather in which they are gathered. As soon as the liquor is poured from the boiler into the agitating vat, it is emptied of its leaves and refilled with a fresh supply of these and of water, and the process thus continues with rapidity.

Where the *Nerium tinctorium* grows plentifully (near Hydrabad) the natives mix the leaves with the real indigo—"a practice," says Heyne, "which I have not observed any where else." A sufficient reason is not assigned why these leaves are not in more general use, since their employment seems to hold out many advantages.

This species of indigo plant does not appear to be subject to any disease, nor is it liable to the devastations of insects. It grows spontaneously over a large extent of land, while the common indigo requires constant and expensive culture on a

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good soil, and is even then subject to many accidents against which no human foresight can guard. The vicissitudes attendant on the cultivation of the *indigofera*, even from the effects of weather alone, are too well known to require enlarging upon. Tennant observes, " a planter whose crops to-day are rich and abundant, whose expectations of a profitable return seem perfectly secure and reasonable, may awaken to-morrow to behold all his hopes completely blasted—a storm of wind accompanied by rain and large hailstones, as completely ruins his crop as if it had been devoured by the locusts. From this latter calamity the indigo planter is not exempt in any part of Bengal."*

* Indian Recreations, vol. ii. p. 150.

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OPIUM.

The product of a species of poppy, *papaver somniferum*, belonging to a genus of the class and order *Polyandria Monogynia*.

Opium is an important article of production in British India. In Bengal it is made an exclusive monopoly of the government, which thence obtains a large revenue. It is said that the profit arising from this branch of trade is not the only reason which has induced the Board of Directors to adopt and pursue this line of policy; that the facility of adulterating so important a drug justifies a monopoly which watches over its preparation, while the object of government in interfering with this traffic is more with a view to controul the use of an article which is so prejudicial to the morals of the people and to the interests of society in general, than with the desire of increasing the revenue; that it would in fact rather restrict the retail trade of opium as much as possible. "Were it possible to prevent the use of the drug altogether, except strictly for the purpose of medicine, we would gladly do it," say the Directors of the East India Company, "in compassion to mankind; but this being absolutely impracticable, we can only endeavour to regulate and palliate an evil which cannot be eradicated." * The predilection for the use of this insinuating drug is, however, too strong to be overcome even by prohibitions and penalties.

In China its use is forbidden by law,† notwithstanding

* Report of House of Commons on East India Affairs, 4th App.

† Hoopoa's Proclamation against it at Canton. Asiatic Register, vol. iii.

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which, that country offers the greatest market for opium, this being the principal article of trade between India and China; thus showing that there, as every where else, vicious appetite is often stronger than legal restraint.

In Rungpore, Dinajpore, and other places, the illicit cultivation of the poppy is carried on to a great extent, notwithstanding the utmost vigilance is used to prevent it, and that punishment is consequent on conviction. Persons found engaged in the manufacture of the article are liable to a fine and to imprisonment for a period of twelve months.

Opium is not, however, produced in this manner in sufficient quantity to injure materially the revenue derived from the monopoly, nor would it seem that the cares of Government have been able in any way to lessen the consumption, since we find that the revenue obtained from the sale of this article was, in 1809-10, 580,000*l.*, and in 1830 had increased to 2,000,000*l.* Little or no opium produced in the East Indies is imported into this country, the trade of it thence being principally confined to China and other Eastern parts.

From evidence taken before a Committee of the House of Lords, printed in 1830, it appears that the consumption of opium among the Chinese is rapidly increasing. From 1800 to 1810, the export from India to China was about 2500 chests, each containing 149⅓ lbs.

In the year 1817-18	2,435	chests were imported into China.
1820-21	3,377	
1823-24	5,930	
1825-26	11,050	
1827-28	9,475	
1828-29	13,132	yielding in dollars, 12,513,715
1829-30	16,305	

The cultivation of the poppy and the preparation of opium from it are largely pursued in Turkey, whence the drug is obtained for English consumption. Turkey opium is considered of better quality for medicinal purposes than that brought from the East Indies.

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POPPIES FROM WHICH OPIUM IS PRODUCED.

1 Common Narcotic Poppy—(Papaver somniferum).
2 Capsule of ditto.
3 Common White Poppy—(Papaver alba).
4 Black Poppy—(Papaver nigrum).
5 Double White Poppy—(Papaver alba-plenum).
6 Double Red Poppy—(Papaver rubro-plenum)
7 Fibrous Poppy—(Papaver fimbriatum).

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The characteristics of the poppy are a flower with an oval indented empalement, composed of two almost oval, concave leaves, which fall off. The corolla is composed of four large roundish petals which spread open with a great number of hair-like stamina, terminated by oblong, compressed, erect summits. In the centre is placed a large, roundish germen, having no style, but crowned by a plain radiated target-shaped stigma; the germen afterwards becomes a large capsule, crowned by the plain stigma, having one cell opening in many places at the top under the crown, and which is filled with small seeds. There are nine species of this plant besides numerous varieties.

The *papaver somniferum* is the species from which opium is obtained. Its root and stem attain to rather a large size, and abound with a bitter juice; the stalk is three or four feet high, having oblong indented leaves resembling those of the lettuce. The flower has somewhat the appearance of a tulip.

The best soil, well-manured, is required for the successful growth of this plant, and the crop demands much labour and attention during its whole progress. For this cultivation the ground is thoroughly pulverised by seven or more ploughings and other stirrings of the earth, after having been well manured with cow-dung or ashes. The ground is then divided into little squares, of from three to five feet, by a slight embankment of earth only a few inches in height. The seed is sown broad-cast in these compartments, in the month of December. The proportion used is from one seer and a half to two seers, or from about 2¾ to 3¾ lbs. avoir. per biggah, not quite one-third of an acre. Eight or nine days after the seed is sown the ground is completely irrigated, the water overflowing its surface to the depth of two or three inches; this irrigation is effected by breaking down a small outlet in each inclosure successively. The irrigation is repeated seven times at intervals of ten or twelve days. After each watering, when the ground is a little dried but still soft, it is stirred with a small iron instrument, so as to loosen it effectually, and the weeds are carefully removed. If the plants should come up too thickly, they are thinned, leaving intervals between them of five or six

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inches. While the plants are very young those which are thus removed are used as pot-herbs, but when they have attained to the height of about a foot and a half they have an intoxicating property, which renders them unfit for this purpose.

The flowers begin to bloom in February, and the capsules become in a fit state for extracting the opium in March or April.

This fitness is shewn about seven days after the petals fall off, by the capsule assuming a whitish colour, and by exhibiting a degree of hardness. Incisions are then made into it with an iron instrument, having three teeth at the distance of half a line from each other. This is drawn from top to bottom of the capsule so as to penetrate the skin. The wounds are made in the afternoon and evening, generally near to the hour of sunset; in some places, the incisions are repeated for three successive days; in others, the operation is repeated every second day for a fortnight or three weeks. From these wounds a white juice exudes, which concretes upon the capsule. It is scraped off with a small iron scoop in the morning at day-break, the work being discontinued after the dew is dispersed. From every fresh incision the produce becomes less abundant, and of an inferior quality. The capsules of the whole of a field are wounded, and the opium collected in about a fortnight. This is kneaded with water till it assumes the consistence of pitch.

The raw juice being thus procured, the preparation of it is carried on in India under the immediate superintendence of the Company's agents. The process consists of evaporating the aqueous particles by the heat of the sun. A small proportion of oil extracted from poppy seeds, is mixed with the opium to prevent the drying of the resin; it is then formed into cakes and covered with leaves of the poppy; when sufficiently dry, it is packed in chests with the chaff of poppy seeds. A considerable reduction of weight takes place in opium after it has been kept for any time; it is reckoned, that fresh opium loses fifteen per cent. in weight by being kept; and, therefore, it is usual, in packing the chests, to include this quantity, over-

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and above the weight which each chest should contain. Extensive buildings are attached to the opium department in the particular districts where it is raised; those at Patna are considered the largest in India. The opium of Behar and Benares is superior to that of Rungpore, or any other part of Bengal; and it has been determined by the Board of Directors, that the latter or inferior drug, shall not be exported, but reserved for internal consumption. In order that the drug of the best quality might be readily distinguished from that of inferior description, it was enacted, that the Bengal opium should not be made into cakes, but instead thereof, should be put into pots or jars, and sold in that state, at a season of the year when poppy leaves are not procurable; and it was declared, that if any person should be detected making Bengal opium into cakes, either with poppy leaves, or tobacco leaves, or any other substance, the opium found in such a state of preparation should be seized and confiscated, and the offender be subjected to adequate penalties.*

In the Mahratta districts, the mode of preparing opium renders it of inferior quality to any prepared under the Company's inspection. Oil is then mixed with the juice even at the time of gathering; the otherwise too great dryness of the drug being assigned as the reason of this practice. The persons employed in the gathering are each provided with a small vessel containing linseed or sesamum oil; into this the knife is dipped with which the concrete juice is scraped off the plant; a little oil is then poured into the palm of the hand; and the opium is rubbed in this and kneaded with it; as more is collected it is added to the lump, so that the whole quantity of a person's daily gathering is brought home kneaded into one mass; this is thrown into a vessel containing oil, into which the entire crop of the season is collected. The proportion of oil in a given quantity cannot, it is evident, be accurately known; it is computed that it amounts to a half of the pure drug, or one third of the mixed mass; a proportion which of course greatly diminishes the value of the opium. This adulteration is, however, per-

* Fourth Appendix to Report of House of Commons on East India Affairs, for 1831.

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mitted; other fraudulent practices are pursued by the natives from which it is difficult to guard. The powder of the seed; the leaves of the plant, and even ashes are sometimes mixed with the opium.

The produce obtained from poppy-grounds is very variable, depending on season and other casualties. It has been estimated by some cultivators at sixty pounds of opium per acre, and by others at thirty pounds per acre; the latter is most probably the nearest to the truth.* At the Mahrattas in a fruitful season, and on good soil, from six to nine seers of opium are obtained from a bigah of ground: a small crop is from two to four seers.†

The white yields more abundantly than the red poppy; the quality of the opium is considered the same in each.

The profit arising from the production of opium is extremely fluctuating and uncertain. An intelligent writer remarks on this subject, "A produce of between twenty and thirty rupees each acre, is perhaps a more scanty reward for so much labour than what is afforded by a crop of corn. But to Europeans, the trade is fascinating; its actual produce almost never coincides with the true average. If insects, wind, rain or hail, destroy the crop of one season, another year peculiarly fortunate enriches all the cultivators. This hazard, instead of checking, encourages individuals in proportion to their hopes of personal good fortune.‡

Quantities of Opium, imported, exported, and retained for Home Consumption in the United Kingdom, in the Years 1829 and 1830.

	Imported.	Exported.	Consumption.
1829....	48,634	41,919	23,970
1830....	209,076	170,080	22,688

The present price of Turkey opium in the market is from 14*s.* 6*d.* to 15*s.* 6*d.* per lb. The import duty is 4*s.* per lb.

* Tennant's Indian Recreations.

† A seer is 1lb. 10oz. 10dr. Avoirdupois.

‡ Tennant's Indian Recreations, vol. ii.

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SENNA—(CASSIA SENNA).

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SENNA.

The dried leaf of *Cassia senna*, belonging to the class and order *Decandria Monogynia*, Nat. Ord. *Lomentaceæ*, Linn. and *Leguminosæ*, Jussieu.

This drug was early known to the Arabian physicians, who treated of its virtues in their writings many centuries before it was noticed by European authors. Actuarius, a Jew physician, who wrote in Greek, and practised at Constantinople in the thirteenth century, is the first European writer who makes mention of senna as a medicine.

Senna is the dried leaf of *cassia senna*, an annual plant, rising with an upright branching stalk about a foot high. The leaves are winged, having four pair of small spear-shaped leaflets ending in acute points. The stalk is terminated by loose bunches of yellow flowers, which are succeeded by legumes of an oblong shape.

This plant is indigenous to Persia, Syria, Arabia and Upper Egypt, whence the leaves are brought, dried and picked from the stalks, to Alexandria; and, being thence imported into Europe, it is called in consequence Alexandrine senna. These leaves are oblong, sharp-pointed at the end, scarcely an inch in length, about a quarter of an inch broad, and of a lively yellowish green colour. An inferior kind of senna from other varieties of the cassia senna, is brought from Tripoli and other places. This is distinguished from the better sort by the shape of the leaves, which is either long, narrower, and sharper pointed, or larger, broader, and round pointed, with small prominent veins; while some of the leaves are large and obtuse, of a fresh green colour, without any tinge of yellow.*

* Miller.

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A variety of the senna plant was found by Burkhardt growing wild in Nubia in great abundance on spots which were subjected to inundations. Its leaf is applied to medicinal purposes by the natives, but it is considered very inferior to the senna of Upper Egypt, which is distinguished by its larger leaves.

Another variety, a native of India, likewise constitutes an article of import into this country; and, though not considered of so good a quality as the Alexandrine, is consumed in larger quantities, bearing a much lower price. This variety of cassia senna has a branching stalk of about one foot and a half high. The pinnate leaves have five pair of blunt leaflets of a sea-green colour and a thick substance. The flowers stand on short peduncles: they are larger and of a brighter yellow colour than the Egyptian variety. This plant is found also on the coast of the island of Jamaica near Port Royal; but, though naturalized there, it was not originally indigenous to the island. In the West Indies the inhabitants make use of the leaves of several species of cassia instead of the true senna.

Senna imported in	1829	- - -	187,492 lbs.
Ditto	Do. 1830	- - -	258,498
Retained for home consumption in		1829 - -	122,601
Ditto	Do.	1830 - -	145,986

The price of Senna (inclusive of duty, which is 6*d.* per pound) coming from

East Indies - -	from 1*s.* 0*d.* to 2*s.* 0*d.* per lb.
Alexandria - -	2*s.* 9*d.* to 3*s.* 3*d.*
Smyrna - -	2*s.* 3*d.* to 2*s.* 8*d.*
Tripoli - -	2*s.* 0*d.* to 2*s.* 6*d.*

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CAJUPUTI-TREE—(MELALEUCA CAJUPUTI).

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CAJUPUTI OIL.

The cajuputi-tree—*Melaleuca Cajuputi.* Class and order *Polyadelphia Icosandria.* Natural order, *Hesperidæ.*

THIS oil is the product of a tree growing in the islands of the Indian Archipelago, and which was long supposed to be the *Melaleuca leucodendron;* but specimens having been sent home to Dr. Christopher Smith, he found that it differed from the latter, and fixed it as a new species. Crawfurd calls these trees myrtles of gigantic growth. They are easily distinguished in the forest by the whiteness of their bark, whence is derived their name *Kayu-puti,* which signifies literally, white wood. They have some resemblance to the birch in their form and appearance. The leaves are alternate and spear-shaped, standing on short petioles. The flowers are white, sessile, and accompanied with minute floral leaves. Three varieties of this tree are found in the Indian islands, as far west and north as the south-eastern coast of Borneo, but they abound chiefly in the islands of Bouro and Ceram. The two largest kinds are applied to useful purposes, — the bark of the largest affords the material with which the natives of the Moluccas caulk their barks. The leaf of the smaller yields by distillation an essential oil, which is known in commerce under the corrupt name of cajeput oil. The smell of this oil is supposed to preserve collections of natural history from the attacks of insects. It has the property of dissolving caoutchouc, by which means a good varnish may be made. It is likewise used in medicine.

The present price of cajuputi oil is from 1*s.* to 1*s.* 3*d.* per ounce, exclusive of duty, which is 1*d.* per ounce.

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CAMPHOR.

The Camphor-tree—*Dryobalanops Camphoræ*, belonging to the class and order *Polyandria Monogynia*. Nat. ord. *guttiferæ*.

From the earliest times, the virtues of camphor appear to have been well known to the Arabian physicians; and Sumatra and Borneo have always been celebrated as the countries of its production.

The ancient Greeks and Romans were unacquainted with this substance, although so early known to the Eastern nations. It was introduced into Europe by the Arabians. The first notice we find of it in any writings, is in those of Ætius, a physician of Amida, who flourished in the fifth century.

The tree whence the best camphor is obtained, is indigenous to Sumatra, but there are many other plants which also yield this peculiar substance. The *laurus camphora* of Japan, as well as the roots of the cinnamon-tree of Ceylon, contain it in considerable quantities. Chemists have likewise extracted it from the roots of zedoary, thyme, sage, &c. and it is supposed to be present more or less in all the labiated plants.

Camphor is not classed among oily, resinous, or any other matters, but is a substance which, from its nature, is ranked by itself, though in many respects, its properties and characteristics agree with those of oils and resins. It is white, pellucid, friable, inflammable, and exceedingly volatile, with a very penetrating odour, and a bitter, acrid, and rather pungent taste. It floats on water, on the surface of which it will burn, leaving no residuum after combustion. It is very electric, and liquefies by the application of heat; it is insoluble in water, but is soluble in alcohol, oil, and other unctuous matter, in yolks of eggs, and in mineral acids.

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CAMPHOR TREE--(DRYOBALANOPS CAMPHORÆ.)

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The camphor-tree propagates itself in the mountains of Sumatra without any trouble or labour to the natives, growing without cultivation in the woods near the sea-coast, at the north part of the island. It is not found native southward of the line, nor yet beyond the third degree of north latitude.

European travellers have not yet been able to ascertain the genuine name of the tree in any of the native languages; but there appears no reason to doubt that its growth is entirely confined to Sumatra and Borneo, and it has now been fully ascertained by the examination of Mr. Colebrooke, that it is a tree of a different genus from the *laurus camphora;* a fact asserted by Kœmpfer, though not generally believed in his time.*

The camphor tree equals in height and size the largest timber trees, being frequently above fifteen feet in circumference.

The trunk is arboreous, having the bark of a brownish hue. The leaves grow on short petioles, the superior ones being alternate, the inferior opposite; they are from three to four inches long and about an inch broad. Their shape is elliptic, terminating in a remarkably long and slender point. The fibres are straight and parallel to each other. The calyx is one-leaved, the capsule is three-valved containing one seed.

The fruit is described by C. F. Gærtner,† under the name of *dryobalanops aromatica*, but he has confounded it with the cinnamon-tree and spoken of it as a native of Ceylon. It is also described by M. Correa de Serra, who designates it *pterigiumteres*, without any reference to the nature of the tree as yielding camphor.

Situations in which the camphor-tree abounds are reckoned unhealthy, owing probably to the nature of the soil and the

* Camphoram naturalem et cristallinum perquam pretiosam ac raram imperitum arbor in Sumatra et Borneo insulis. Sed hæc arbor ex *Daphneo sanguine non est.*"

† De Seminibus, vol. iii. p. 4, tab. clxxxvi.

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peculiar circumstances requisite for the flourishing state of that tree.

Camphor is called by the natives kapūr bārus. The word kapūr is derived from the Sanscrit karpūra, and the Arabic and Persian kāfūr, whence our name camphor has been corrupted, from the language of the country where the substance is produced. Bārus is the name of a place which is the principal mart of the commodity in Sumatra, and is therefore, affixed to the other name by traders to distinguish it from the similar product of Japan.

The camphor is found in a concrete form in natural internal fissures in the wood, either in grains or scales; the latter sort, or lamellar, is considered better than that which has a granular fracture. The exterior appearance of the tree affords no indication by which to judge whether it contains sufficient camphor to be worth the labour of cutting it down. It is, therefore, no uncommon circumstance for many trees to be hewn before one is found which is sufficiently rich in camphor to reward the exertions of the collector. It might almost be said, this work is pursued at random, although it is never commenced without the attendance of a professional conjuror, who directs the researches, but who cannot give any reason for his judgment beyond favorable dreams, and his skill is chiefly evinced by the address he employs in excusing or accounting for his own mistakes. It is said, that not more than one in ten trees which are felled, is productive of either camphor or camphor-oil, and that parties are sometimes engaged in the forest for two or three months together, with very doubtful success. The trees are cut transversely into large blocks, and are then, by the aid of wedges, split into smaller pieces. The camphor, if there be any, is found in the interstices of the wood whence it is extracted. That which comes off readily in large flakes, is of the best quality, and is distinguished as head-camphor; an intermediate sort consists of the smaller clean particles, that of the third quality is obtained by scraping the wood, which is therefore often mixed with it, rendering it impure; this is called foot-camphor. It is divested of extraneous matter by being soaked in water, and soap is sometimes

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employed to assist in this operation. It is then passed through sieves of different degrees of fineness that it may be separated according to the size of the grain; it is likewise carefully assorted by hand, and particular trouble is taken to distinguish it from the concentrated oil, which is not considered the pure native camphor. The produce of a middling sized tree, is reckoned at nearly eleven pounds. Oil of camphor is obtained from the same tree, and its presence is of less rare occurrence than that of the camphor. Though this product be called oil, it partakes more of the nature of a liquid or volatile resin.

To procure it, a transverse incision is made into the tree to the depth of some inches, the wood is then cut off a little above the notch in a sloping direction downwards, so that a flat horizontal surface is obtained; this is hollowed out, till of a sufficient capacity to receive a quart of liquid. A piece of lighted reed is then put into the hollow where it is suffered to remain for about ten minutes, this acts as a stimulus and draws the fluid to that part. In the space of one night a liquid flows from this incision in sufficient quantity to fill the receptacle prepared for it; the tree continues to yield a smaller quantity for three successive nights, when fire must be again applied, but after a few applications the oil is exhausted.

The natives have a method of pouring the oil into the natural fissure of the wood of the inferior trees. This being exposed to the sun every day for a week, concretes, and takes the form and appearance of genuine camphor, but it is of very inferior quality. It is probable, however, that this essential oil deposits itself in the crevices of the wood while in a state of vegetation, and as the tree increases in age, it hardens and becomes camphor. When the fresh oil is left for subsidence it is said that a sediment of camphor is produced.

It was formerly supposed, that the people of China and Japan, prepared a factitious substance resembling the native camphor, and impregnated this with its virtues by the admixture of a small quantity of the genuine drug. The real state of the case is now, however, fully ascertained, and it is known that the camphor of Japan is the genuine produce of a tree

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growing abundantly in that country, differing in its character,* from that growing in Sumatra and Borneo, and well known to botanists as the *laurus camphora.*

The Chinese always distinguish the camphor of Sumatra from that of Japan, reserving the former for their own use at an extravagant price, and exporting the latter as a substance which they hold in little estimation. The camphor from Sumatra, is never brought for sale to this country, but is so much prized by the Chinese and other eastern nations, that its price† is, to that of Japan, in the ratio of twenty to one, which arises, perhaps, rather from the superstitious virtues ascribed to it than from the intrinsic difference in their real value.

The camphor-tree of Japan — *laurus camphora,* belongs to a genus of the class *Enneandria Monogynia.* Natural order *Holoraceæ* or *Lauri* of Jussieu. It is a large tree with ascending branches. The bark of the stem is somewhat rough, but on the inner surface is smooth and mucous, and, therefore, readily separated from the wood, which is dry and of a white colour. The leaves stand upon slender petioles, they are of an oval form running out into a point, having their upper surface smooth, and of a lively and shining green, the lower surface is herbaceous and silky; a few lateral nerves extend in a curve from the mid-rib to the circumference, these nerves frequently terminate in small excrescences, a circumstance peculiar to this species of laurus. The leaves mostly grow alternate on the branches, but some are opposite. The flower-stalks proceed from the axillæ of the leaves; they are slender and branch out into very short pedicles, each supporting a single flower. The corolla is white and consists of six petals. The tree does not blossom until it has attained to a considerable age and size. The fruit is a purple and shining berry, of the size of a pea; it is composed of a soft pulpy substance having the flavour of cloves and camphor, and encloses a kernel of an insipid taste, covered with a black shining pellicle.

This tree grows to the size of our largest elms and oaks.

The Chinese affirm, with their usual exaggeration, that it

* Marsden, Crawfurd, &c.

† Crawfurd's Indian Archipelago, vol. i.

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CAMPHOR--(LAURUS CAMPHORA.)

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sometimes attains the height of more than 300 feet, and acquires a circumference greater than can be embraced by the extended arms of twenty men.* The trees that Mr. Abel† saw during his journey, did not, by their magnitude, at all justify this description. The largest of those he observed, measured twenty feet in circumference, and was fifty feet high; it was chiefly remarkable for the size of its branches, many of them being nine feet in circumference.

The camphor from this tree is obtained by two methods; the one by inflicting wounds in the bark whence it exudes, the other by the aid of fire; the drug obtained by the former method is esteemed as being very much superior in quality.

To obtain it, incisions are made in the trunk, and the substance which issues is collected in basins. About three pounds at most are collected from one tree. The very great purity of this kind, and the property of evaporating less readily in the atmosphere, gain for it a much higher price in commerce, so that one pound of camphor obtained in this manner in Japan, costs as much as one hundred pounds of camphor produced by artificial means.‡ The latter kind, distinguished as artificial camphor, is procured by cutting the roots and other parts of the tree in small pieces, and boiling them in water. This operation is performed in a spherical iron vessel furnished with a capital, or covered by a second iron vessel of an elongated form, filled with straw or reeds. The camphor contained in the wood, sublimes by the action of heat, and attaches itself by flakes to the straw, in which state it is transmitted to Europe, where it is refined in order to fit it for use. Formerly the Phœnicians were the only people who practised this art. The Dutch then took it up, and retained it for a long time to the exclusion of other people; but camphor is now refined in England and in other parts of Europe.

Rough camphor comes to us from the East Indies, packed in wooden boxes, being in small masses mixed with

* Lettres Edifiantes, tom. xxii. p. 192.

† Abel's Journey in the Interior of China.

‡ Journal des Connoissances usuelles et pratiqués, tom. i. p. 100.

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various extraneous matters. The process of refining is performed by bruising these pieces of camphor, or by passing them through a mill, and in this state the substance is placed in small glass retorts with the addition of chalk or slaked lime. Each retort is then inserted in an iron vessel filled with sand, which is placed upon an iron furnace. About fifty of these vessels are operated upon at the same time. Turf is used for fuel in order to obtain an equal and constant degree of heat. When the fire is lighted, the vessel containing the camphor is provided with an iron capital, the neck of which descends to the edge of the vessel containing sand, without touching the retort. As soon as the moisture, collected on the capital, condenses sufficiently fast to run off, the capital is removed, and the opening of the retort is closed with a wooden stopper. The camphor beginning to fuse, sublimes and adheres to the sides of the retorts, in the form of flakes which resemble snow, and which take a solid and transparent consistence. To prevent the passage of the neck of the retort from being obstructed, it is freed by means of a strong iron needle, thus affording egress to the gas. The purified camphor attached to the top of the retort is collected from time to time, while the impure substance remains at the bottom.

The sublimation being ended and the retorts being left to cool, they are broken in order to take out the lumps of camphor. The lumps, which weigh about two pounds, are concave on one side and convex on the other, having a hole in the middle, occasioned by the perforation of the needle, by means of which the communication was kept up with the external air.

The most striking difference in the qualities of the three kinds of camphor noticed, consists in their volatility. Japan camphor, obtained by boiling the wood, will volatilize entirely away by exposure to air; that obtained naturally in Japan will in some measure lose its weight under the same circumstances, while it is said that the Sumatra kind does not diminish in any sensible quantity by being kept.* It has been observed that a hundred pounds of camphor of Japan, of the first quality, loses only ten pounds by evaporating freely in the

* Marsden.

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air, while the same quantity, artificially obtained, entirely evaporates away during the same period of time.*

Camphor is well known as a medicinal drug, besides which it is applied to many of the arts. It is employed in varnishes, and particularly in the kind known as gold lacquer. It is also employed in making fire-works, as much on account of the readiness wherewith it ignites, as of the whiteness which it imparts to the flame. The property which it has of burning on water has induced the supposition that it entered into the composition of the Greek fire. Its smell is fatal to small animals, and particularly to some insects. For this reason, it is often placed in boxes where stuffed animals are kept, to preserve them from moths and other insects, which otherwise might come to deposit their eggs. The same use of it is made in preserving furs and woollen cloths. Camphor likewise enters into the composition of aromatic pastilles.

The oil of camphor is a valuable medicine, much used by the natives of Sumatra in strains, swellings, and rheumatic pains.

The wood of the tree has a strong aromatic odour; and from its supposed virtue of keeping away insects, is employed for making clothes presses, and other similar articles. It is easy to work, light and durable, but is much affected by changes of atmosphere.

The price of unrefined camphor is 13*l.* per cwt. exclusive of duty. The duty is 1*s.* per cwt, and on refined camphor 4*s.* per cwt.

* Journal des Connoisances, &c.

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RHUBARB.

Rheum Palmatum, a genus of the *Enneandria Trigynia* class and order. In the natural order *Holoraceæ* of Linnæus, and *Polygoneæ* of Jussieu.

This well-known drug is the root of a plant indigenous to eastern countries. The best is produced in that part of eastern Tartary which serves as a boundary between Russia and China. The rhubarb-plant grows there so abundantly that the inhabitants do not think it worthy of becoming an object for cultivation. In that country it springs forth spontaneously as if the seeds had been dropped with design, its growth being in little regular tufts, not running out and spreading itself in the manner of docks. The marmots, which burrow under the shade of its spreading leaves and probably feed on its roots, contribute to its increase by casting up and loosening the earth all around, thus placing it in a good state for receiving the seeds scattered abroad by the wind, and which, in consequence, immediately take root. Rhubarb is cultivated in China, whence its root is also obtained, but it is not nearly of as good quality as that coming from Tartary.

Some years ago great efforts were made to naturalize this plant in England. The Society for the Encouragement of Arts, &c. offered premiums for its successful cultivation, and many specimens of English rhubarb were accordingly offered for inspection; the result led to the hope of ultimate success, but analysis showed that the virtues of the drug resided in a much smaller degree in that produced in our climate, than in the root of foreign growth, and there is every reason to sup-

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RHUBARB--(RHEUM PALMATUM.)

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pose that our winter is too cold and humid, to allow the properties of the root to be sufficiently elaborated. The plant itself has, however, become quite acclimatized in this country, although it is not in general cultivation. Two other species of rhubarb are generally preferred for garden culture, since the part used for culinary purposes, the petiole of the radical leaf is much larger in these than in the plant which yields the rhubarb of commerce, and which is distinguished as *rheum palmatum*. This has a perennial root, which is thick and of an oval shape, and from which issue long tapering branches. The root is externally brown, and internally, of a deep yellow colour. This sends forth an annual cylindric erect stem, hollow and jointed, branching towards the top, and from six to eight feet high. There are, likewise, numerous large radical leaves, these are rough and palmate, deeply cut into lobes and irregularly pointed segments, their petioles are long, smooth and round. From each joint of the stem a leaf of the same shape proceeds from a membraneous sheath. The stem-leaves successively decrease in size as they grow higher on the stalk. The flowers surround the branches in numerous clusters forming a kind of spike. They are of a greenish-white colour, and are followed by large three-sided seeds. This species is distinguished from the other by the greater beauty of its leaves — by its superior height — the reddish-brown colour of the stem and petioles, and the elegant form of the little panicles of flowers.

A light sandy soil, where no moisture can settle and stagnate, is found to be the most favourable for the growth of rhubarb.

Bell relates, that in Tartary, where it grows spontaneously, the earth is so loose that by merely turning it up with a stick he readily obtained the root. Much manure tends to canker the plants, and it may be doubted whether the use of any is advantageous. The seed is sown in the spring broadcast, moderately thick. It may be either sown at once on the spot where it is intended to remain, or the young plants may be removed when they are about four or five inches high. In the first season some attention is required for this culture, if the

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weather be hot and sultry, the tender plants should be shaded; and if the season be very dry, watering is requisite, though the soil in itself can scarcely be too dry, for there is more evil to be feared from a superabundance of moisture, than from any actual want of it. The plants, when young, are liable to injury from slugs and other vermin, from which they should be protected; they should also be weeded and thinned, the distance left between the plants being about four feet.

The growth of rhubarb is remarkably rapid even in this climate. Miller speaks of a plant six years old which grew eleven feet four inches between the month of April, when the stalk first emerged from the ground, and the middle of July, when it was at its greatest height. It grew in one day three, and in one night above four inches,. Many of the leaves were more than five feet long. The roots taken up in October, when cleared, washed, and deprived of the small fibres, weighed thirty-six pounds. There are diffeent opinions as to the best age for taking up the roots. Some say when they are from five to six years old, others eight; and Bergius recommends the eleventh year as the most favourable age for obtaining the useful properties of the root, in the greatest quantity and of the best quality.

The Chinese select the winter season for digging up the crop. According to Pallas, the Tartars collect it in the spring. Bell asserts that autumn is the time in which they take up the roots; while Forster affirms that the roots are dug up in winter before they put forth leaves, and while vegetation is still dormant in them, because they then contain the entire juice and virtue of the plant. Those that are taken up in the summer are spongy and unfit for use.

The Tartars, after digging up and collecting the roots of rhubarb, rasp off the outer rind and cut the large roots into small pieces, for the greater convenience of drying them. For this purpose they are placed on long tables or boards and turned three or four times a-day, that the yellow viscid juice may incorporate with the substance of the root. If this juice be suffered to run out the rhubarb becomes light and unserviceable. Immediately on the roots being dug up, they

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should be cut and dried; if left for five or six days they become soft and decay speedily. In four or five days after being first laid to dry, a hole is drilled through the middle of each piece, to facilitate the drying as well as for the convenience of stringing the pieces together on a cord. It is found by experience that the central part, from its proximity to the sap, is the most moist and liable to decay,* and, that if this is cut out, it will tend to the preservation of the remaining part of the root. The pieces strung together are hung up, and in two months are completely dried and in full perfection. The loss of weight incurred in the process of preparing the root is very considerable, seven parts of the undried root yielding not more than one part of the rhubarb of commerce.

The Chinese, after cleansing and scraping off the outer bark of the roots, as well as the thin yellow membrane underneath, cut them into slices an inch or two in thickness, and dry them on stone slabs, under which large fires are kindled. They are not, however, sufficiently desiccated by this operation, after which, a hole is made in each piece, and they are, according to Grosier, suspended on lines, in a situation exposed to the greatest heat of the sun, till they are sufficiently dry to be kept without danger of spoiling. Rochon, on the contrary, asserts that the rhubarb of China is always dried in the shade.

The drug from Tartary, known in England as Russia or Turkey rhubarb, because imported from those countries, comes to us in roundish pieces with a hole through the middle of each; it is externally of a yellow colour, and internally is variegated with lively reddish streaks. The Chinese drug, coming to us direct from the East Indies, is not considered of so good a quality as the foregoing. It is in rather long pieces, harder, heavier, and more compact than the foregoing. That coming from Tartary is, however, more liable to become mouldy and worm-eaten. It is said that sometimes ingenuity is exercised in fraudulently filling up these worm-holes with certain mixtures, and colouring the outside of the damaged

* Miller.

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pieces with powder of the finer sorts of rhubarb, and sometimes with cheaper materials.

The good quality of rhubarb may be estimated by the liveliness of its colour, and by its proving firm and solid when cut, without being flinty or hard; it should be capable of being pulverised readily, and the powder should appear of a bright yellow colour.

The component parts of rhubarb are found by analysis to be as follow:

Water*	8·2 parts.
Gum	31
Resin	10
Extract, tannin, and gallic acid	26
Phosphate of lime	2
Malate of lime	6·5
Woody fibre	16·3
	100 parts.

The quantities of rhubarb imported into England in the years 1829 and 1830, were as under:

	1829.	1830.
Russia	10,659	3,544
Netherlands	..	157
France	461	..
Italy	..	361
Cape of Good Hope	8,074	..
St. Helena	..	4,041
East Indies	127,443	153,170
China	242	..
	146,879	161,273

The price of this drug is now

Russian	7	0 to 7	6	per lb.
Dutch	3	2 to 5	6	
East Indies	2	10 to 3	3	

duty inclusive. The duty on importation is 1*s.* per lb.

* Quarterly Journal of Science and Arts, vol. x. p. 291.

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SOCOTRINE ALOES—(ALOE SOCOTRINA).

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ALOES.

A genus of the *Monogynia* order, belonging to the *Hexandria* class of plants, and in the natural method ranking under the tenth order, *Coronariæ*.

THE drug which bears the name of aloes is the inspissated juice of a species of aloe. It is used for medicinal purposes, and is obtained from both the East and West Indies. That coming from Socotora, an island in the straits of Babelmandel, is considered the best. Its production in the West Indies is mostly confined to the island of Barbados, where it is said the plant was originally introduced from the Bermudas.

There are several species of this aloe: Miller enumerates twenty-five. The *aloe perfoliata*, and the *aloe spicata*, are the species from which the aloes of commerce is obtained. The first species has long, narrow, succulent leaves, which grow irregularly, forming large heads. The stem attains to the height of about three or four feet, and has two, three, and sometimes four of these heads branching out from it. The flowers are of a bright red colour, tipped with green; they grow in loose spikes, on very short peduncles. They have no calyx; the corolla is monopetalous, or formed of only one petal, which is erect, oblong, and divided into six segments at the edge. It is of a tabular form, and gibbous, having both upper and under surface convex, on account of a pulpy matter intervening. The fruit is an oblong capsule, divided into

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three cells, containing many angular seeds. The *aloe perfoliata Barbadensis* is a variety of this species, from which the drug is obtained in Barbados. The lower leaves of this plant spread out on all sides, but the upper leaves converge towards the centre; the stem is about two feet high; the flowers, which are of a bright yellow colour, grow on long footstalks. The *aloe spicata* has a stem four inches in diameter, and three or four feet in height; leaves, about two feet in length, spread on every side. They are subverticallate, channelled, acute, with remote teeth; the flowers are in very close spikes, spreading horizontally, a foot in breadth; the corolla is well-shaped, and full of a purple, honey juice. The whole plant is of a dusky hue.

These plants will thrive on the most dry and barren soil, and grow wherever they find mould enough to cover part of their roots. They are propagated by suckers, set in little shallow pits, from six to twelve inches apart, and kept perfectly free from weeds. The manner of preparing the juice differs in different countries.

The following account of the cultivation and preparation of aloes in the island of Barbados, is taken from the eighth volume of the London Medical Journal. "The lands in the vicinity of the sea, that is, from two to three miles, which are rather subject to drought than otherwise, and are so strong and shallow as not to admit of the planting of sugar-canes with any prospect of success, are generally found to answer best for the aloe-plant. The stones, at least the larger ones, are first picked up, and either packed in heaps, upon the most shallow barren spots, or laid round the field as a dry wall. The land is then lightly ploughed and very carefully cleared of all noxious weeds, lined, at one foot distance, from row to row, and the young plants set like cabbages, at about five or six inches from each other. This regular mode of lining and setting the plants is practised only by the most exact planters, in order to facilitate the frequent weeding by hand, because if the ground be not kept perfectly clean and free from weeds the produce will be but very small. Aloes will bear being planted in any season of the year, even in the driest,

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as they will live on the surface of the earth for many weeks without a drop of rain. The most general time of planting them, however, is from April to June.

" In the March following, the labourers carry a parcel of tubs and jars into the field, and each takes a slip or breadth of it, and begins by laying hold of a bunch of the blades, as much as he can conveniently grasp with one hand, while with the other he cuts it just above the surface of the earth, as quickly as possible (that the juice may not be wasted), and then places the blades in the tub, bunch by bunch, or handful by handful. When the first tub is thus packed quite full, a second is begun (each labourer having two); and by the time the second is filled, all the juice is generally drained out of the blades in the first tub. The blades are then lightly taken out and thrown over the land by way of manure; and the juice is poured out into a jar. The tub is then filled again with blades, and so alternately, till the labourer has produced his jar full, or about four gallons and a half of juice, which is often done in six or seven hours, and he has then the remainder of the day to himself—it being his employer's interest to get each day's operation as quickly done as possible. It may be observed, that although aloes are often cut in nine, ten, or twelve months after being planted, they are not in perfection till the second and third year, and that they will be productive for a length of time, say ten or twelve years, or even for a much longer time, if good dung or manure of any kind, is strewed over the field once in three or four years, or oftener if convenient.

" The aloe juice will keep for several weeks without injury. It is therefore not boiled till a sufficient quantity is procured, to make it an object for the boiling-house. In the large way, three boilers, either of iron or of copper, are placed to one fire; though some have but two, and the small planters only one boiler. The boilers are filled with the juice, and as it ripens or becomes more inspissated by a constant but regular fire, it is laded from boiler to boiler, and fresh juice is added to that farthest from the fire, till the juice in that nearest to the fire (by much the smallest of the three) becomes of a proper con-

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sistency to be skipped or laded out into gourds or other small vessels used for its final reception. The proper time to skip or ladle it out of the last boiler is, when it has arrived at what is termed a resin height, or when it cuts freely, or in thin flakes from the edges of a small wooden slice, that is dipped from time to time into the boiler for that purpose. A little lime-water is used by some aloe-boilers during the process, when the ebullition is too great."

The best kind is sometimes inspissated without fire-heat. The process is simple, though extremely tedious. For this purpose as soon as the leaves are cut, they are put in tubs that the liquor may ooze out from the wound. The juice thus obtained, is either put into bladders left quite open at top and suspended in the sun, or into broad shallow trays, exposed every dry day until the fluid parts are evaporated, and the extract becomes of a sufficient consistence.

A different manner of preparation to that pursued in Barbados, is practised in the other West India Islands, where this plant is occasionally cultivated. The leaves being cut close to the roots, they are carefully cleansed from all impurities; then sliced into pieces and put into small hand baskets or nets. These baskets are placed in large iron boilers filled with water, and the whole is boiled for ten minutes; the leaves are then taken out, and a fresh parcel supplied till the water becomes black, and is supposed to be strongly impregnated with the juice. The liquor is now poured through a strainer into a deep vat narrow at bottom, where it is left for subsidence. On the ensuing day, the supernatant liquor freed from the feculent parts, is drawn off clear by means of a cock, and again committed to the iron vessel, and subjected to heat. At first it is allowed to evaporate rapidly, but as it gradually thickens, more care is required to prevent its charring, and towards the end of the process it is continually stirred while the ebullition proceeds very gently. When it becomes about the consistence of honey, it is poured into gourds or calabashes and hardens by age.*

* Edwards' West Indies.

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Aloes of the best quality is distinguished as Socotorine, because brought from Socotora: it is a glossy and semi-transparent substance of an orange colour, with a purple cast, and, when reduced to powder, of a bright golden colour. It is hard and friable in a cold temperature; becomes pliable in warm weather, and grows soft by the application of the heat of the hand. This drug is of an intensely bitter taste, slightly aromatic, but not sufficiently so to prevent it from being extremely nauseous.

Aloes of the second quality is distinguished as *aloe hepatica*. This kind is most commonly met with in our druggists' shops. It is obtained from the variety of the *aloe perfoliata Barbadensis*, and is brought to this country principally from Barbados. It is not so clear or bright as the former; its colour is darker inclining to a dusky red or liver colour, whence its distinctive name. It is of a more compact texture and generally drier; its smell is more disagreeable, and its taste still more nauseous than the Socotorine species.

Aloes of the third quality is the most impure, the blackest, and the strongest. It is chiefly distinguished by its rank powerful smell. This is called cabilline, or horse-aloes, because it is little used except as a medicine for horses and cattle. It was formerly employed by the Indians instead of tar to preserve the bottoms of their boats. This, according to some accounts, is a coarser sort, obtained from the same species of aloe as the foregoing; according to others it is the produce of the *disticha* species, which is not so large a plant, seldom rising above two feet high. The leaves are very broad at the base, where they closely embrace the stalk, and gradually decrease to a point. The edges are set with sharp spines, and the under leaves diverge laterally on all sides. They are of a dark green colour spotted with white; the flowers appear in umbels at the summit of the stalk; they are of a beautiful red colour.

The inspissated juice of the aloe is a gummy resinous matter so well blended together, that aqueous or spirituous menstrua separately dissolve the greater part of both. The general nature of the three kinds appears to be the same; their particular differences consist in their degree of purity from extraneous

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substances, in the different proportions of gum and resin, and in the flavour which is more or less disgustful. According to analysis it appears that the Socotorine description contains scarcely half the quantity of resin which is held in combination by an equal weight of the hepatic.

The price of Barbados aloes at the present time is 2*l.* per cwt. including the duty, which is 2*d.* per lb.—at the same period of the year in 1830, this drug was 10*l.* per cwt. the duty being then 1*s.* 3*d.* per pound.

The price of dry hepatica in bond, is from 5*l.* to 14*l.* per cwt. and of aloes from the Cape, 2*l.* to 5*l.* per cwt. A duty is charged on foreign aloes of 8*d.* per lb.

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CASTOR-OIL PLANT—(RICINUS COMMUNIS).

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CASTOR-OIL.

Castor-oil plant — *Ricinus communis* — belonging to a genus of the class and order *Monœcia Adelphia.*

The plant from which castor-oil is obtained, grows in great abundance in almost every part of India. It is a hardy plant, thriving alike on the burning plain and on the coldest heights of the mountain.

In the Mysore country, two varieties of the castor-oil plant —*ricinus*—are much cultivated. The oil expressed from the larger kind, distinguished as *ricinus communis fructus major*, is used for burning in lamps, and is the cheapest oil to be found in India. This plant grows commonly without the least attention being bestowed upon its culture, and when once it has established itself in any particular spot, it is very difficult of eradication.

The seeds of the *ricinus communis fructus minor* yield the castor-oil of commerce, well known in pharmacy. This plant is likewise sometimes termed the *palma Christi.*

The plant is of rapid growth, often attaining to the height of fourteen or fifteen feet; it has a round thick-jointed furrowed stem, glaucous at the lower part, gradually acquiring a purplish hue towards the top. The leaves grow singly on very long petioles; they are large and palmate, being deeply divided into from eight to twelve serrated lobes of a bluish-green colour. The flowers are disposed in terminating racemes, which spring from the division of the branches; the male and female flowers are placed on the same spike, the male below; the female at the upper part of the spike. They are both without petals; the former have swelling empalements, and a great number of slender stamina, which are connected in several bodies and terminated by roundish twin summits. The female flower has a three-cleft reddish calyx

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armed with prickles; the oval germen, in the centre, changes into a trilocular capsule, about the size of a marble, of a pale-green colour and covered with flexible prickles. When arrived at maturity, it bursts elastically, and expels the seeds, usually three in number. These are of an oblong flat form, of nearly quite a white colour, and of a heavy mawkish taste.

The oil from these seeds is obtained either by expression, or coction; in the second mode it is more liable to rancidity, though so prepared it looks clearer, has a beautiful pure amber colour, and is nearly divested of all unpleasant smell or taste.*

This plant is much cultivated in the West, as well as in the East Indies, and the oil forms an article of commerce into this country from both hemispheres. The trade of castor-oil in the East Indies, is nearly limited to the demand for this article in Great Britain; the shipments of it to other places having rather the character of private supplies than of commercial transactions.†

In Java, the castor-oil plant is cultivated together with mountain rice, being thinly interspersed among the rice, with the growth or reaping of which, it does not materially interfere. The Chinese cultivate it largely, and use the product as an esculent oil; they having, it is said, some means by which to divest it in part of its medicinal qualities.

Quantities of Castor-oil imported into this Country, and retained for Home-consumption in the Years 1829 and 1830.

	Imported,	Consumption.
1829.....	396,104	293,028
1830.....	490,558	334,497

The price of East India castor-oil, is from 6*d.* to 1*s.* per lb. exclusive of duty; and that coming from the West Indies, is 1*s.* per lb. inclusive of duty. The duty, is 2*s.* 6*d.* per cwt. coming from British possessions; and from other parts, 112*s.* per cwt.

*Ainslie's Materia Indica. † East India Report for 1831.

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ANISEED.

Pimpinella Anisum. Class and order, *Pentandria Digynia.* Natural order *Umbellatæ.*

THIS production is distinguished into two kinds, the common and star-aniseed.

Common aniseed is produced from a small plant which is a native of Egypt, but which has been naturalized in Europe, and is much cultivated in Spain and Malta. One variety is likewise cultivated in Germany, but the seed coming thence is not considered of good quality. It is a small and delicate annual plant, producing only one stalk, and seldom rising above a foot in height. The leaves are roundish, lobed, and toothed; the flowers, which are small and white, are succeeded by the aromatic seeds known in commerce. The root soon dies after the seed has come to maturity, and this usually takes place about July.

The cultivation of the *pimpinella anisum,* being pursued in Europe, any further particulars regarding it might be considered out of place in this volume. The foregoing slight notice is inserted, as introductory to some account of star-aniseed, which is better entitled to be considered a tropical production.

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STAR-ANISEED.

The aniseed-tree — *Illicium*, so called from *illicio* to attract; because of its alluring odour. It belongs to the class and order *Polyandria Polygynia*. Natural order, *Coadunatæ*, Linn. and *Magnoliæ*, Juss.

This tree is a native of China and Japan where it is held in much esteem. In China the seed is in frequent use for seasoning dishes. In Japan the whole plant takes a higher rank, assuming an almost sacred character. The people wear aromatic garlands of its foliage, which they place in their temples before their idols, and on the tombs of their departed friends. They also burn the pulverized bark as incense on their altars. This bark, when very finely powdered, is likewise used in a kind of time-piece, which denotes to the watchman of the night the regular intervals as they elapse. For this purpose the powder is strewed on some ashes, in small winding grooves, in a box secured from the weather. This powder being lighted at one end, burns slowly and regularly, and when it arrives at certain marked stages, the watchmen strike a bell, being able by means of this indicator, to proclaim with accuracy the stated periods of the night.*

The aromatic seeds of this tree have been long well known all over the East; and, so early as the time of Queen Elizabeth, Sir Thomas Cavendish brought into England, from the Philippine Isles, some branches, bearing the husk and seeds, but without leaves or blossoms.

* Thunberg.

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STAR ANISEED — (ILLICIUM).

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This plant grows to about the height and size of a cherry-tree, rising with a smooth arboraceous stem. The branches are wrinkled and angular, spreading in an upright direction. The leaves grow alternately, and likewise in tufts of three or four together at the ends of the small branches. They are evergreen, of a paler colour underneath than on the upper surface, of a blunt elliptic shape, becoming broader near the tip, and about two inches in length. The petiole is very short and channelled, gradually widening into the leaf. The flowers are yellow, growing from the axillæ of the branches on solitary peduncles; the corolla is composed of sixteen petals; the whole flower, when seen at a distance, bears a strong resemblance to the Narcissus.* Eight or more germs are contained in each flower, whence proceed from six to eight capsules, growing together horizontally, and radiating from one point; they are ovate, lanceolate, and somewhat compressed, the aggregate bearing the exact shape of a star about the size of a sixpence, and nearly a quarter of an inch in thickness;† it is of a pale brown colour, and a leather-like substance, rugged without and smooth within. The capsules, as well as the seeds which they contain, have a strong smell of anise. The seeds are smooth and glassy, of a cinnamon colour, and an elliptic form. The whole plant, but more especially the fruit, has a pleasant aromatic odour. It is propagated either by seeds, layers, or cuttings, which strike freely.

But a very small quantity of this seed finds its way into the London market.

A species of *illicium* has likewise been found growing in both the East and West Floridas. Its form and growth are very similar to the oriental species, and its seeds have the same shape and aroma as those coming from the east.

Mr. Bertram, the king's botanist for the Floridas, in 1766, thus describes this tree. "Near here, [on the banks of the St. John], my son found a lovely sweet tree, with leaves like

* Kœmpfer.

† Bauhin, in his Historia Plantarum Universalis, designates this tree as *zingi fructus stellatus*, from the shape of its capsules.

‡ Ainslie's Materia Indica.

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the sweet bay, which smelled like the sassafras, and produces a very strange kind of seed-pod, but all the seed was shed, the *severe frost* had not hurt it. Some of them grew near twenty feet high, a charming, bright evergreen aromatic." At about the same time, the same species of tree was accidentally discovered growing in West Florida.

The flowers of the *Illicium Floridanum* are of a dark-red colour; the corolla is composed of from twenty-one to twenty-seven petals, and the star-capsules are mostly made up of from twelve to thirteen rays.

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INDEX.

A.

Acerredores, 98.
Achem, coco-nut of, 249.
Adelphia, 413.
Aloe perfoliata, 405.
spicata, 405.
perfoliata Barbadensis, 406.
cultivation of plant, 406.
manner of obtaining the juice, 407.
after-process, 407.
different qualities of, 409.
nature of, 410.
price of, 410.
Aloes, 405.
America, cultivation of cotton in, 34.
when first introduced, 35.
cultivation of tobacco in, 152.
indigo imported from, 335.
Amomum Zingiber, 317.
cardamomum, 331.
Anecdote, 119.
Aniseed, common, 417.
star, 418.
description of, 419.
Arrack, 261.
Arrow-root plant, where cultivated, 238.
derivation of its name, 238.
description of, 238.
manner of preparing, 241.
East India, 241.
description of, 242.
Artocarpus integrifolia, or jacca-tree, 310.

B.

Barbados, aloes of, 405.
Barrow's China, 178.
Bennet, Mr. his experiments in the cultivation of cotton, 44.
Bertolacci's Ceylon, 251, 255.
Blast in cotton, 23.
Blé de Turquie, 196, 202.
Branche Gourmande, 66.
Brazil, cacao of, 103.
Buée, M. his cultivation of the clove-tree, 292.

C.

Cacao, history of, 85.
plantations in Mexico, 87.
soil requisite for its culture, 88.
method of cultivation, 89.
duty on, 90.
Average produce, 90.
progress of vegetation, 93.
description of, 94.
seeds of, 97.
pruning, 97.
liable to the attacks of insects, 97.
disease, 98.
gathering of crop, 99.
separating seeds, 100.
cacao husks, 106.
importation of into Great Britain, 107, 108.
Cacava Quahuitl, 85.

Digitized by Google

Cajuputi-tree, description of, 383.
Camphor, history of 384.
nature and properties of, 384.
from what plants obtained, 384.
tree indigenous to Sumatra, 384.
description of, 387.
in what situation flourishes, 387.
manner of obtaining, 388.
from the Laurus Camphora, 393.
in what state imported into Europe, 394.
manner of refining, 394.
difference of quality in, 394.
uses of, 395.
price of, 395.
Camelia, 121.
Canæ, 238.
Canara, coco-nut of, 249.
Caraccas, cacao of, 102.
Cardamom, description of, 331.
where native, 331.
manner of being produced, 332.
Cardamom-seed, indications of quality, 332
mode of packing, 333.
monopoly in, 333.
price of, 333.
greater, 333.
Carolina, rice of, 181.
Caryophyllata, 287.
Cassava, where indigenous, 232.
description of, 232.
soil most favourable to — manner of cultivation, 235.
preparation of, 237.
poison of juice, how corrected, 237.
Cassia, imports, exports, &c. 286.
price of, 286.
buds, 280.
senna, 379.
Castor-oil plant, where growing—description of, 413.
where cultivated, 414.
Caterpillars, 26, 97.
Cement, strength of, 260.
Ceylon, cinnamon of, 268.
coco-nut of, 249.
captured by English, 274.
Chalias, 271, 282.
Chana, 244, 254, 257.
Chenille, 24.
precautions taken against, 25.
Chinese, adepts in fraud, 121.
poverty of labourers, 123.
consumption of opium among, 369.
China, cultivation of cotton in, 28.
of millet, 212.
of tea, 120,
of rice, 175.
Chingkariang, 310.
Choo, 212.
Chocolate, 103.
manner of preparing, 104.
Chocolatl, 85.
Cimex, 24.
Cinnamon, history of, in Ceylon, 268.
Dutch monopoly of, 271.
plantations formed, 273.
trade of, 274.
declared free, 276.
English monopoly of, 275.
where cultivated, 276.
tree, description of, 276.
quality of, affected by local circumstances, 279.
soil most favourable, 280.
manner of cultivating, 281.
progress of, 281.
different modes of propagating the tree, 281.
now largely cultivated, 282.
mode of peeling, 283.
quality of, 284.
manner of packing, 285.
oil of, 285.
imports, exports, &c,, 285.
price of, 286.
Clove-tree, history of, 287.
its growth attempted to be confined to Amboyna, 287.
largely cultivated there, 288.
where introduced, 288.
description of, 288.
time of coming to maturity, 291.
gathering the crop, 292,
culture of at Dominica, 292.
Cloves, imported from St. Vincent's into England, 293.
oil of, 293.
quantity retained for home consumption, 294.
imported, exported, &c. 295.
price of, 295.

Digitized by Google

Coadunatæ, 418.
Coco nucifera, 243.
Coco-nut tree, history of, 243.
value of, 244.
locality of, 245.
description of, 246.
species of, 249.
soil and situation most favourable to its growth, 251.
duration of tree, 251.
top necessary to its vitality, 252.
cultivation of, 252.
progress of, 253.
abundant produce of, 255.
products of, 255.
properties of the stem, 256.
grows in large quantities in Ceylon, 263.
Coco-nut oil, 255.
Coffee, history of, 51, 53, 56.
great consumption of, 52, 55.
advantages arising from its cultivation, 53.
when introduced into the West Indies, 54.
reduction of duty in, 54.
Coffee-tree, description of, 56.
soil favourable to its cultivation, 60.
method of cultivation, 61.
progress of vegetation, 63.
time of bearing, 67.
manner of renewing plantations, 67.
produce, 68.
gathering of, 69, 70, 74.
subsequent process, 69, 71, 72, 73.
Arabian process, 73.
pulp of fruit, use of, 71.
packing, 75.
shipping, 76.
quality of the berry, 76, 83.
manner of roasting, 77.
preparing the beverage, 82.
clearing, 83.
berries improve by keeping, 83.
importation of into England, 84.
fly, 68.
mill, description of, 72.
pounding, 74.
Coir, 255, 261.
quality of, 262.
Columnifera, 1.
Corn, Guinea, 215.
Corn, Indian. *See* Maize.
Coromandel coast, coco-nut of, 249.
Coronariæ, 405.
Cotton, history of, 1.
use of, 2.
plant, different species of, 2.
soil most favourable to its growth, 8.
previous preparation of ground, 9.
choice of manures, 11.
choice of seed, 11, 13.
cultivation of fallen off in the West Indies, reason of, 12.
method of cultivation, 14.
plant, pinching off the top of, 16.
pruning, description of pods, 17.
gathering of crop, 18.
drying, 21.
separation of seeds, 21.
plants, casualties of, 23.
nurseries for, 27.
cultivation in China, 28.
in Indian Isles, 33.
introduction into America, 34.
cultivation, 38.
produce of, 41.
quantity gathered in one day, 41.
proportion of seeds to wool, 41.
sorting produce, 41.
expences of a plantation in America, 42.
in West Indies, 43.
quantity exported from America, 44.
imported into Great Britain, 44, 50.
exported from, 50.
experiments in the cultivation of, 44
quantity cleansed in one day, 48.
Cotton, bowed, 22.
Sea Island, 38.
Cotton gin, 47.
roller gin, saw gin, 48, 49.
Curcuma Angustifoliæ, 241.

D.

Dampier's account of the sago tree, 229.
Decandria, 379.
Dhowrra, 215.
Diandria, 109, 305.

Digitized by Google

Digynia, 169, 212, 417.
Dioecia, 296.
Dominica, culture of clove in, 292.
Donovan, Mr. his directions for roasting, preparing, and clearing coffee, 77, 81, 86.
Dutch negociate with the King of Candy, 270.
make a treaty with the Portuguese, 271.
strive at monopoly, 271.
management of cinnamon trade, 272.
cultivate cinnamon, 273.
enforce penalties, 273. 275.
conduct with regard to the clove, 287.
the nutmeg, 296.
the pepper, 305.
Dryobalanops Camphoræ, 384.

E.

Edwards' history of West Indies, 26, 43.
Elettaria, 331.
English obtain possession of Ceylon, 273.
ill management of the cinnamon trade, 275.
act with better policy, 276.
Enneandria, 268. 390. 396.
Epidendrum, 109.
Eruz, 169.
Erythrina Corallodendron, 310.
Euphorbia, 232.

F.

Falk, Governor, 272.
Fan, Chinese name for rice, 178.

G.

Ginger, history of, 317.
quantity exported from Jamaica, 318.
description of, 318.
manner of cultivating, 321.
method of preparing the roots, 321.
of preserving, 321.
quantitv imported, &c. 322.
price of, 322.
Gomi, 136.
Gossypium, 1.
Herbaceum, 2.
Gossypium, Indicum—Micranthum—Arboreum, 5.
Vitifolium—Hirsurtum—Religiosum—Latifolium, 6.
Barbadense—Peruvianum, 7.
Gramineæ, 169, 196, 212.
Grub, 68.
Guiana, cacao of, 102.
Guttifera, 384.
Gynandria, 109.

H.

Handbill, curious, 118.
Hesperidæ, 287, 383.
Heyne, Dr. 357.
Hexandria, 169, 243, 405.
Holcus Sorghum, 212, 215, 219, 220.
Saccharatus, 222.
Holoraceæ, 390.

I.

Icosandria, 325, 383.
Illicium, 418.
Floridanum, 420.
Indicum, 334,
Indigo, history of, 334.
cultivated in America, 335.
in Java, 336.
description of plant, 339.
different species, and where indigenous, 340.
soil favourable to its culture, 341.
progress of vegetation, 342.
seed of, 342.
plant liable to casualties, 343, 368.
manner of preparing in West Indies, 344.
in Bengal, 353.
recommended by Dr. Roxburgh, 355.
at Madras, 356.
at Ambore, 358.
on the Coromandel coast, 358.
in Java, 359.
in Egypt, 359.
in Senegal, 360.
factories in East Indies, 352.
dyers prejudiced against some kinds of, 357.
qualities of, 360.

Digitized by Google

Indigo—*continued.*
component parts of, 361.
chemical nature of, 361.
important article of export from East Indies, 361.
profit of an indigo factory, 362.
quantity exported from Bengal, 363.
number of factories, 363.
manufactured at Madras in small quantities, 364.
quantity imported into England, &c. 364.
prices, 364.
Nerium, description of, 365.
gathering of leaves, 366.
extracting colour of, 366.
advantages of, 367.
Indigofera, 334.
description of, 339.
where indigenous, 336.
argentea—tinctoria, 339.
anil—Americana, 340.
cœrulea, 341.
pseudo tinctoria, 358.
Indian islands, culture of cotton in, 33.
Indian corn. See *Maize.*
Indies, East, factories of indigo in, 352.
Indies, West, cultivation of coffee in, 54.
of cotton, 12.
manner of preparing indigo in, 344.
Irrigation, when desirable, 22.

J.

Jacca tree, 310.
Jagery, 259.
Japan, camphor of, 389.
tea of, 130.
Jasminum Arabicum, 51.
Jatropha manihot, 232.
janipha, 232, 237.
Java, introduction of tea into, 123.
cultivation of pepper in, 305.
luxuriant vegetation of, 182.
cultivation of indigo in, 336.
of rice in, 181.

K.

Kapūr bārus, 388.
Karuwa, 280.
Kœmpfer, 387.

L.

Labat, Father, 120.
Labour, allotment of, 39.
Lauri, 390.
Laurus Cinnamomum, 268.
Cassia, 280.
Camphoræ, 384.
description of, 390.
Le Goux de Flaix, M., 256.
Leguminosæ, 379.
Lime, its efficacy, 26.
used in making jagery, 260.
Lomentaceæ, 379.
Luridæ, 148.

M.

Mace, 301.
quantity retained for home consumption, imported, &c., 303.
Magdalena, cacao of. 101.
Maize, history of, 196.
where grown, 199.
varieties of, 200.
manner of cultivating in Mexico, 201.
in America, 203.
frequent ploughings necessary, 204.
transplanting recommended, 204.
suckering, 205.
topping, 206.
when arrived at maturity, 207.
gathering of the crop, 207.
how preserved, 207.
how separated from the cob, 208.
uses of the different parts of the plant, 208.
liable to the attacks of birds, 209.
great produce, 209.
analysis of, 209.
uses of, 210.
Maldives, coco-nut of, 249.
Malvacea, 85.
Maracaibo, cacao of, 101.
Maranta, 238.
Mats of coco-nut leaves, 255.
Melaleuca leucodendron, 383.
Metroxylon sagu, 223.
Mexico, cacao of, 87.
indigo of, 336.
cultivation of maize in, 203.
Millet, where cultivated, 212.

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Millet—*continued.*
grain from two different kinds of plants so called, 215.
great Indian, description of, 215.
common, description of, 216.
German, 216.
Italian, 219.
manner of cultivating, 219.
common, injured by attacks of birds, 220.
precautions taken, 221.
gathering in of the crop, 221.
produce of the plant, 221.
golden-coloured, 222.
Mirra, 255.
manner of obtaining, 257.
jagery made from, 259, 261.
Monadelphia, 1, 232.
Monandria, 238, 241, 317, 331.
Monœcia, 196, 212, 232, 243, 413.
Monogynia, 51, 115, 148, 238, 241, 268, 287, 317, 325, 331, 369, 379, 384.
Myrta, 287.
Myrtus Pimento, 325.

N.

Nicobar Isles, coco-nut of, 249.
Nicot, Lord of Villemain, 151.
Nicotiana, 148.
Nurseries for cotton, 27.
coffee, 63.
cacao, 93.
Nutmegs, monopoly of, 296.
the Dutch endeavour to restrict its cultivation to Banda, 296.
where cultivated, 297.
produce of at St. Vincent's, 298.
Nutmeg-tree, preparations for its culture in Trinidad, 298.
description of plant, 298.
manner of propagating the plant, 301.
when arrived at maturity, 301.
subsequent treatment, 301.
liable to the attacks of worms, 302.
oil of, 302.
whence imported, 302.
monthly consumption of, 303.
imported, exported, &c. into England, 304.

O.

Oil of cinnamon, 285.
clover, 293.
nutmegs, 302.
pimento, 328.
cajuputi, 383.
camphor, 389, 395.
castor, 413.
how obtained, 414.
quantity imported, price of, &c. 414.
coco-nut, 255.
where used, 263.
manner of expressing, 264.
congeals at low temperature, 265.
quantity obtained from one tree, 265.
manner of preparing in England, 266.
Ootsein, 136.
Opium, East India monopoly, 369.
its use forbidden by law, 369.
with what success, 370.
illicit trade in, 370.
revenue obtained, 370.
consumption among the Chinese, 370.
largely cultivated and prepared in Turkey, 370.
preparation of, 374.
quality of that of Bengal, 375.
manner of preparing in the Mahrattas, 375.
produce of opium variable, 376.
quantity imported, &c. 376.
Orchideæ, 109.
Oriza, 169.
sativa—præcox—mutica, 173.
glutinosa, 175.
Orizivora, 185.

P.

Paddee, 173, 187, 195.
Palma Christi, 65, 413.
Pan-cul-tcha, 136.
Panicum-Miliaceum, 212, 215, 216, 219, 220.
Germanicum, 216.
Italicum, 219.
Papaver somniferum, 369, 373.

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Pentagynia, 85.
Pentandria, 51, 148, 417.
Pepper, history of, 305.
cultivation of, in Java, 305.
in Sumatra, 306.
in Cayenne, 309.
description of, 309.
manner of planting and cultivating, 311.
when at maturity, 312.
subsequent management, 312.
plantations of, 313.
gathering crop, 314.
different qualities of, 314.
white, 314.
abundant produce from vines, 315.
quantity retained for home consumption, &c. 316.
Pimento, description of tree, 325.
plantations of, 326.
gathering crop, 327.
produce, 327.
oil of, 328.
quantity imported, &c. 328.
Planters, West India, carelessness in choice of cotton seed, 43.
Pimpinella aniseed, 415.
Piper nigrum, 305.
Polyadelphia, 85 383.
Polyandria, 1, 115, 287, 369, 384, 418.
Polygamia, 212.
Polygoneæ, 396.
Polygynia, 418.
Poppy, 369.
somniferum, described, 373.
cultivation of, 373.
when capsules arrived at a proper degree of maturity, 374.
price of, how procured, 374.
preparation of, 374.
grounds, produce of, 376
Portuguese, discoveries of, 270.

R.

Raffles, Sir Stamford, 165, 305.
Raleigh, Sir Walter, introduced tobacco into England, 151.
Rats destructive to coffee, 68.
Rheum palmatum, 396.
Rhubarb, 396.
where indigenous, 396.
attempts to propagate it in England, 396.
description of, 399.
soil favourable to its culture, 399.
manner of cultivating, 399.
rapid growth of, 400.
collecting crop, 400.
subsequent process, 401.
Russia, 401.
Chinese, 401.
component parts, 402.
price of, 402.
quantity imported, &c. 402.
Rhumphius, 227.
Rice, history of, 169.
introduced into Carolina, 169.
description of, 170.
varieties of, 173.
common—early—mountain, 173.
clammy, 175.
periods of coming to maturity, 175.
Chinese method of cultivating, 175.
much used in China, 178.
method of cultivation pursued in Hindostan, 178.
manner of irrigation, 180.
Mountain, cultivated in Java, 181.
but little cultivated in Ceylon, 184.
method of cultivation in Carolina, 184.
Southern Europe, 186.
manner of cleaning, 187.
improvements in, 188.
advantageous crop, 193.
relative crops in Bengal, Nepal, Java, 193.
Lombardy, Carnatic, 194.
wine made from, 194.
arrack made from, 194.
quantity imported into England, 195.
price of, &c. 195.
Rice-bird, 185.
Rice-mill, 177, 188, 190, 191.
Rohr, Dr. 7, 15, 17.
Rosquilla, 98.
Roxburgh, Dr. 341, 355.
Rubiaceæ, 51.

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S.

Sago-tree, where indigenous, 223.
description of, 224.
varieties of, 224.
its different stages, 227.
manner of ascertaining its maturity, 227.
collecting and preparing pith, 228, 229.
little labour in obtaining it, 229.
amazing produce, 228.
other parts of the tree applied to useful purposes, 230
quantity imported, &c. 231.
price of, 231.
Sagu, 223.
Scitamineæ, 238, 241, 317, 331.
Senna, description of—where indigenous, 379.
quantity imported, &c. 380.
Short, Dr., his dissertation on tea, 117.
Soconusco, cacao of, 101.
Socotora, aloes of, 405.
Spalding, Mr., letter from, 35.
Sparrow's nest, 245.
St. Vincent, culture of cloves in, 292.
introduction of cloves in, 297.
Sumatra, cultivation of pepper in, 306.
Syngenesia, 296.

T.

Tanks in India, 180.
Tapioca, 237.
Tea, history of, 115.
fable of its origin, 115.
introduction into Europe, 117.
opposition to, 118.
shrubs supposed to be identical with, 121.
attempts to introduce the plants into other countries 121.
expence of preparation, 122.
introduction of, at Java, 123.
varieties of, 124.
description of, 127.
locality of plant, 128.
temperature of climate in the tea country 128.
manner of cultivating plant, 129.
gathering of leaves, 129.
Tea, gathering, day's work, 129.
number of crops, 130.
Emperor's, 131.
manner of curing as practised in Japan, 131.
as practised in China, 132.
Bohea, 128, 132.
Singlo, 129, 134, 138.
Hyson, 129, 135.
Congo—Pekoe—Souchong—Lintessein, 133.
Hoping, 134, 137.
Honan, 134.
Ankoy, 134, 137.
Bing, 136.
Gunpowder, 137.
manner of packing and keeping, 138.
quantity produced, 139.
increased consumption in England, 140.
number of people employed in the preparation of, 140.
prices of in 1730, 140.
shipped by East India Company, 141.
prime cost, quantity sold, and amount of sales, 141.
tables concerning, 142, 143.
account of the sales of East India Company, &c. 146, 147.
Tennant's Indian Recreations, 179, 193.
Theobroma, 85.
Tobacco, two varieties of, 148.
description of, 148.
productiveness of plant, 151.
when discovered, 151.
its name, whence derived, 151.
general use of, 151.
principally grown in the United States of America, 152.
progress of its cultivation, 152.
prohibition of its growth in England, 152.
monopoly of, 153.
extraordinary act concerning, 153.
cultivation of, 154.
transplanting of, 155.
topping, 156.
suckering, 157.
insects hurtful to, 157.
blight, 157.
gathering crop, 158.
curing-house, 159.

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Tobacco—*continued.*
manner of curing, 160.
when fit for shipment, 161.
stripped leaves, 162.
packing, 162.
size of casks used, 164.
cultivated in the East, 164.
Indian inferior to American, 164.
cultivation of in Java, 165.
relative qualities of, 166.
Shiraz, 167.
method of cultivating, 167.
Toddy, 255.
manner of obtaining, 257.
arrack distilled from, 261.
Triandria, 196, 212.
Tricoccæ, 232.
Trigynia, 305, 396.
Trinidad, cacao of, 102.
preparation for the culture of nutmegs in, 298.
Tschiffeli, M, experiments on millet, 221.

U.

Udsi, 130.
Umbellatæ, 417.

V.

Vanilla, 106, history of, 109.
easily cultivated, 109.
Mexican, best quality, 110.
Brazil, 110.
description of, 110.
its pod, 113
cultivation of, 110.
crop time, 113.
curing process, 113
Virginia, when colonized, 152.

Z.

Zea Mays, 196.
Americana, 200.
Alba, 202,
Vulgaris, 202.

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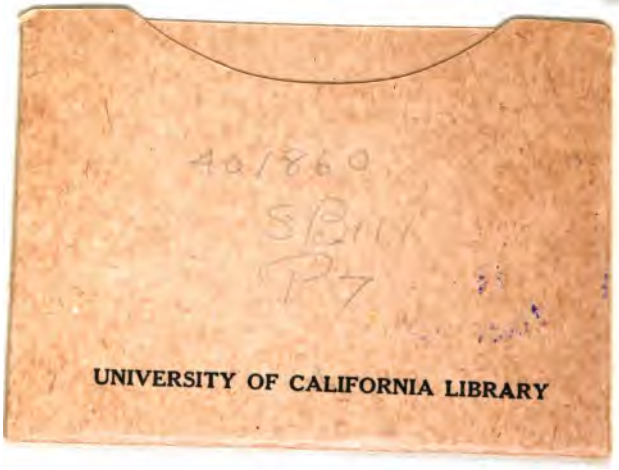

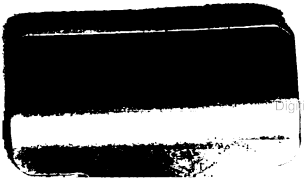

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